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Editorial

HEALING OF FRACTURES

THE basic formula for the process of bone repair was known to John Hunter and his enlightened contemporaries in the eighteenth century. They traced the process from the incipient fracture hematoma through its early transformation into fibrous and, at times, fibrocartilaginous soft callus followed by the deposition of new bone, leading to the final stage of reformation of the medullary canal and the resorption of excess bone.

To the first formula of reparative osteogenesis James Paget in the nineteenth century added a second dealing with what may be called the structural aspect of fracture healing. He described two distinct forms of callus, each separate in purpose but overlapping in time and location. The first, an early "uniting" or *primary callus*, develops from the periosteum of both fragments at some distance from the fracture surfaces. It soon crosses external to the fracture space and serves to hold the fragment ends in place. The second, a "healing" or *definitive callus*, develops within the fracture space partly from endosteum and cancellous marrow and partly from the cells of the primary callus at the level of the fracture. This mature callus re-established continuity of the internal architecture of the broken bone.

These two formulas have never been altered although certain intermediate phases have been added to the first, and fairly rigid structural rules have been worked out for Paget's general principles.

A fracture is classically defined as a traumatic dissolution of continuity of bone. The actual incident of trauma is in itself the effective stimulus to a chain of physiologic and histologic reactions which in predictable sequence constitutes the process of reparative osteogenesis. This healing process is entirely a local reaction confined to the vicinity of the fracture. Any systemic reactions such as vasomotor, metabolic or endocrine which occur in a patient whose bone is broken is incidental and, in a precise sense, not demonstrably related to the healing of that bone. In spite of much deductive reasoning to the contrary and with full recognition of the many past flurries of apparent but unconfirmed observations, 200 years of intensive investigation have failed to discover any consistent effect exerted by normal systemic physiologic processes upon the local phenomenon of reparative osteogenesis.

With these observations in mind the proper study of fracture healing is the fracture. Also, it must be recognized that the impulse to heal is inevitable at the start and inexorable in its completion unless local causes either pathologic or mechanical intervene.

When a bone is broken, a number of tissue reactions occur simultaneously in the vicinity of the fracture. Depending upon the nature of the injury a variable amount of tissue destruction occurs along the fracture surfaces and neighboring soft tissues. Such tissue destruction leaves in its wake areas of necrosis which must be removed by the blood stream or by cellular scavengers. At the same time local hemorrhage takes place, with extravasation of blood into the adjoining tissue spaces and dilatation

of the surrounding blood vessels producing active local hyperemia. This immediate cellular and fluid response to trauma makes up that composite histologic process known as the reaction of inflammation the purpose of which, in its broadest sense, is the cleansing and healing of a wound.

Unless vessels of the largest caliber are injured, hemorrhage soon stops, the blood clots, histiocytes and other invading cells enter the area of the fracture space, and granulation tissue is formed. Evidence of granulation tissue can be found at operation between twenty-four and seventy-two hours after injury. Experience has taught that manipulation of the fracture at any time during this period does not measurably interfere with or retard healing because such simple granulations are rapidly reformed. In due course the granulations are converted into fibrous tissue, the soft callus of the older writers.

In most other wounds of the body healing stops here. Bone is one of the very few tissues which after such healing recreates its own histologic substance. Between the fifth and eighth days the fracture space may be found almost filled with this fibrous tissue. However, it is seldom equally dense in all its parts. Discrete areas of fresh bleeding may be found. Where displacement of fragments is wide, unfilled spaces may remain for a long time.

Between the tenth and twentieth days isolated islands or threads of cartilage may appear in scattered areas of the soft callus. These remain discontinuous and do not to any degree form the pattern of either primary or definitive callus. The significance of this occasional cartilage is not known. It does not appear to influence the quality, quantity or time of ossification. Scudder many years ago discussed an observation of his own to the effect that these cartilage nests occurred most frequently in fractures when immobilization was relatively difficult. Cartilage appears in large amounts in the healing of fractures in laboratory animals. These observations suggest that cartilage is formed within the mass of soft callus as a response to the stimulus of greater than ordinary internal strain. It is found less often in well immobilized fractures. The importance of the observation if not the hypothesis will be apparent further in the article.

During this period and evidently unrelated to the soft callus of the fracture space, a primary callus of immature bone has developed directly from the periosteum above and below the traumatized area. The distance which it extends is conditioned solely by the demands of the position of the fragments. Its structural pattern is designed to form most economically a partially circumferential strut which crosses the fracture space and holds the fragments fixed in their established positions while the definitive callus is consolidating. This primary or external callus is for the most part a temporary structure. That portion of it which will ultimately come within the structure of the definitive callus will be replaced by mature bone. The rest of it will be resorbed as its structural usefulness passes during the remodelling phase of healing.

From the fifteenth to the thirtieth days, then, a rather firm fibro-fibrocartilaginous conglomerate composed of variable proportions of each of its elements develops within the fracture space. This conglomerate is ordinarily formed enough to prevent movement of the fragments except by additional external force. It is further supported by the primary callus crossing its periphery. It must be strongly emphasized at this point that the definitive callus of mature bone which re-establishes the internal continuity of the fragments must replace this increasingly dense fibro-fibrocartilage by the invasion of trabeculae from the surrounding osseous surfaces. The cartilage element must first be destroyed in the path of advancing bone. Occasional nests of cartilage may be encircled and remain for an unmeasured period of time. This process of ossification of the soft callus is not one of metaplasia; it is a matter of replacement. Since the area is not avascular, one need not wait for "creeping replacement"; but even so, it is a time-consuming process.

Experience at the operating table has shown far better than histologic studies that the density of this ossifying conglomerate is variable. At this stage of healing controlled steady traction either in direct line or against angulation is often still possible without danger of delaying the process. This has been accomplished in severe fractures of the femur eight weeks postfracture, and even in a few cases in the tenth week by means of heavily weighted skeletal traction. However, any manipulation after the seventh to tenth day of healing which by sharp or extensive maneuver

breaks the continuity of soft callus must seriously retard union and may even incite involution toward non-union.

Attention must finally be focused on a third basic concept of bone repair, the concept of the healing point. The healing point of a fracture can be defined as that point or moment during the process of reparative osteogenesis at which callus has been formed in sufficient strength to enable the bone to withstand the stresses and strains to which it is normally accustomed in its sound state. This point is obviously subject to many variables. It does not occur at the end of the healing process since a later phase continues past this point and is concerned with remodelling of the healed bone. For the purist one may postulate two healing points, an effective healing point concerned with the functional definition just given and an anatomic healing point representing a complete restoration of normal bone structure. Only the first of these concerns the surgeon; the second is the province of the investigative osteologist. Daily experience teaches that functional healing occurs long before restored normal architecture is demonstrable.

This concept, the effective or functional healing point of a fracture, was developed during the present century. It is the problem of greatest anxiety, second to that of non-union, to the practicing surgeon. T. P. McMurray of Liverpool spoke of it correctly in 1942 when he stated, "Figures collected by different surgeons with respect to the normal rate of union of any particular fracture are of comparatively little value because the standard varies so greatly as to what clinical and x-ray evidence constitutes union."

Judgment in any given case expresses the probability of healing a considerable time after effective healing may have occurred; however, even in the most experienced hands, unless they are overly conservative to the economic detriment of the patient, judgment is too often fallacious. Interpretation of x-ray films, manual resistance and auscultatory percussion as first described by Lippmann all contribute to the surgeon's decision. The last of these has been found surprisingly dependable in the hands of those who have acquired proficiency in its use. It should be more widely learned.

However, it has been shown that none of these three measures is at all dependable following treatment by methods of internal fixation. Manual resistance is a useless test against a properly fixed plate or an intramedullary nail. Auditory or other conduction waves are modified beyond meaning by the metal. Lastly, x-ray appearances are altered to a very great extent and may be entirely misleading. For example, the external callus in the presence of a well applied plate should be minimal and almost invisible on the x-ray film. Because of this the relative radiotranslucency of the fracture line often remains visible long after effective healing has occurred. This expresses the time taken to ossify the definitive callus to the point of roentgenologic equality with adjacent bone; above all it does not express distraction of the fragments if these were correctly apposed at the time of operation.

Except for the fact of non-union, which is ultimately a measurable phenomenon, few other facts in the progress of fracture healing are as yet measurable *in situ*. The time factor in healing of experimental animals has never been applicable to man. It is chiefly by experience with open reductions at different periods of healing that clinical evaluation of the stages of repair can be best understood. Until a method of determining the healing point of a fracture *in situ* is discovered, judgment remains a matter of experience based on knowledge of the progressive stages of these processes. It is possible that improved estimates may come out of recent attempts at quantitative electronic measurements of bone density. In the meantime it is well to remember that it lies in the nature of every fracture to heal itself unless prevented from doing so by mechanical or pathologic faults. When such faults do not exist by the nature of the lesion, this inate drive to heal must be protected and, above all, must not be obstructed.

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Original Articles

SURGICAL TREATMENT OF CARDIOSPASM

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THE symptom complex known as cardiospasm has long been recognized. Willis[1] in 1679 was the first to record the group of symptoms and Purton[2] in 1821 was probably the first to describe the condition accurately as we know it today.

Cardiospasm is a functional form of stricture of the lower end of the esophagus presenting at least in its earlier phases no evidence of an organic lesion of the esophageal wall; it varies considerably as to the progressiveness in dysphagia. In contradistinction to the usual findings in organic strictures such as carcinoma there is a more marked dilatation of the esophagus above the obstruction, hence, hypertrophy of the circular muscle fibers. Ordinarily the aforementioned condition responds readily to adequate therapeutic dilatation which gives varying degrees of relief of symptoms; and when this is the case, the procedure of choice is probably that of periodic dilation sufficient to establish and maintain adequate metabolic balance.

The object of this paper, however, is to deal with the small 2 to 5 per cent of cases which over a period of time become cicatricial in nature with the production of an organic constriction at the cardia which does not respond to dilation.[3] In other words an organic obstruction which cannot be readily relieved has taken place and requires further intervention than the dilations just mentioned.

The exact mechanism and etiology of cardiospasm has not been satisfactorily worked out; however, at the present time most workers believe that the disease is due to a distorted neuromuscular mechanism at or below the level of the diaphragm. Whether this is due primarily to vagus activity with spasm or sympathetic preponderance with inability of the circular muscle to relax remains unknown.[4] The complications resulting from the obstruction are esophagitis, dilatation lengthening and sagging of the esophagus which assumes characteristic shapes described as fusiform, flask or sigmoid. One of the most important complications is that of regurgitation of food which may result in pulmonary infection and fibrosis.

The symptoms accompanying cardiospasm vary a great deal; they may be mild or severe. A dilated esophagus is usually found by the radiologist in barium studies of the gastrointestinal tract. When symptoms are severe there is usually inability to swallow past a certain point; this results in regurgitation of almost all food. Some patients are able to swallow only very soft or liquid food and that in small quantities. Even in these severe cases simple dilatation of the constriction is adequate at times; however, the fibrotic, stenosed lesion previously mentioned which produces the severe symptoms more often than not requires surgical intervention.

All cases of dysphagia should be thoroughly studied not only by x-ray and fluoroscopy but also by a direct esophagoscopic examination in an effort to exclude malignancy as the two may closely simulate each other. A bougie passed through the esophagoscope readily discerns whether or not cicatricial changes have taken place and is an invaluable aid in determining the resiliency of the distal esophagus.

Surgical intervention has been aimed at the dilated esophagus first, second the cardia, third the diaphragm and fourth the nerve supply. Today the frequent approach taken is directed toward the cardia. Mikulicz[5] was first to point out the need of treating the sagging esophagus as well as the obstruction. In 1903 he reported the method of transabdominal, transgastric digital dilation of the cardia.[6] Although he reported excellent results,

there was no advantage over the peroral passage of dilators not counting the additional risk of opening the stomach. Wendel[7] in 1910 described a procedure similar to the Heinecke-Mikulicz pyloroplasty in which a longitudinal incision was made through the area of obstruction and then sutured transversely. Heyrovsky[8] in 1921 performed the first successful esophagogastrostomy for cardiospasm. Heller[9] in 1914 described his extramucous cardio-esophagotomy similar to the Ramstedt operation for congenital pyloric stenosis; this procedure was an abdominal approach through which the muscle fibers of the distal esophagus and cardia were incised down to the mucous membrane producing in most cases adequate relief of symptoms.

The author, however, believes that the procedure of choice is best determined at the time of operation; also, the procedure, regardless of the methods used, should be performed using the transthoracic approach since adequate exploration of the esophagogastric region can thus be easily made. At this time either an esophagogastric anastomosis can be made or the Heller type of esophagoplasty can be applied to the fibrotic muscle fibers of the distal esophagus. This muscle-splitting procedure is less hazardous, much more easily done and apparently very effective.

With the recent advances in anesthesia, surgical technic and chemotherapy, transthoracic exploration carries no higher morbidity and mortality rate than an upper abdominal laparotomy. By using this approach better visualization of the esophageal pathologic condition, mobilization of the esophagogastric junction, examination of the diaphragmatico-esophageal ligament and the easier performance of cardioplasty are allowed. With this approach the transthoracic Heller type of operation possesses certain advantages in selected cases (i.e., extreme ease of performing the operation, relief of the obstruction, adequate exposure and excellent visualization and greater safety factor. A tear occurring in the friable mucosa can be easily repaired and, if desired, the operation can be converted into an esophagogastrostomy.

TECHNIC

The patient is prepared for about four days preoperatively using oral penicillin, 50,000 units every three hours and 1 gm. of sulfadiazine every four hours. Depending upon the appearance of the esophageal mucous membrane and retained food particles as noted by esophagoscopy, saline irrigation may be used to obtain thorough cleansing of the esophageal lumen. Only liquids are allowed by mouth and if necessary blood transfusions are given to obtain satisfactory preoperative conditions.

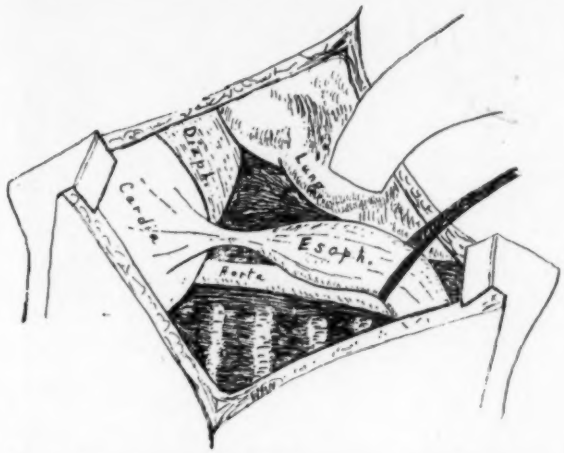

FIG. 1. Demonstration of the area of organic contracture at the esophagogastric junction as noted in most cases of cardiospasm needing surgical intervention.

Under endotracheal anesthesia a left posterolateral thoracotomy incision is made through the bed of the ninth rib. The lung is retracted and the lower end of the esophagus is carefully examined and mobilized. The diaphragm is opened through the hiatus and any limiting bands are excised. The cardia is then mobilized and the area of obstruction examined. Usually in these cases coming to surgery a definite area of cicatricial stenosis is noted. (Fig. 1.) In the absence of extreme sagging and lengthening of the esophagus determined by x-ray studies and observation the Heller type of esophagoplasty is carried out. (Fig. 2.) A longitudinal incision through the constricting muscle fibers is made through the area of obstruction and extended to a normal area of esophagus and stomach. This is very important, that is, to extend the incision well above and below the site of constriction, especially over the cardia. After the constricting muscle fibers have been split and dissected off, the mucosa will be observed to bulge out thereby producing an enlargement of the esophageal lumen. (Fig. 3.) The area is carefully examined for any tears which if present are repaired with interrupted fine silk

sutures. Penicillin and streptomycin are placed locally about the cardioplasty. The diaphragm is repaired and, carefully, a new hiatus is made above the former area of obstruction if possible. Fine silk sutures are then placed

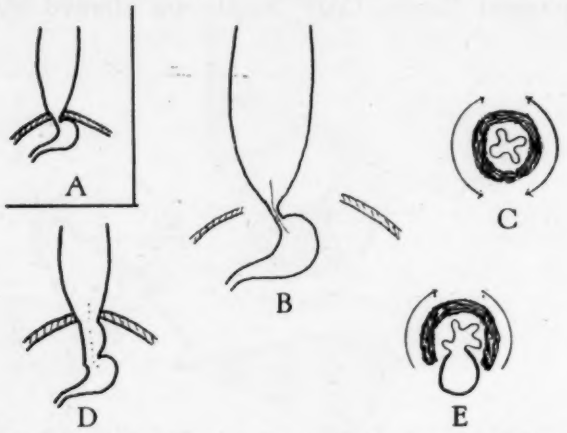

FIG. 2. Diagrammatic picture of the muscle-splitting operation for cardiospasm. A, cardiospasm; B, diaphragm opened through the hiatus, exposure of the esophagogastric junction and line of incision to be made through the circular muscle fibers; C, cross section of esophagus showing mechanism of obstruction by contraction of the circular muscle fibers; D, completed cardioplasty; E, cross section of esophagus showing split muscle fibers and mechanism of the resulting bulge of esophageal mucosa.

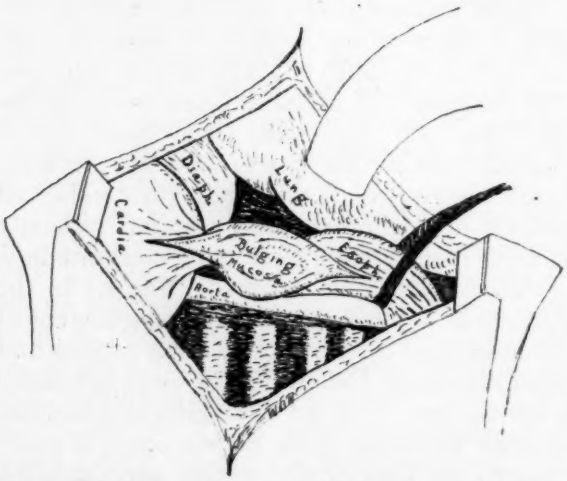

FIG. 3. Demonstration of the bulging esophageal mucosa following the longitudinal split in the circular muscle fibers.

through the diaphragm and muscularis of the esophagus thereby aiding in the fixation.

The chest is closed with water seal drainage. The patient is supported throughout the procedure from whole blood. Postoperatively penicillin is administered. Fluids are started by mouth on the second day and gradually increased to a regular diet. Early ambulation is practiced.

CASE REPORTS

CASE 1. L. Y., a forty-eight year old married white woman, entered the hospital complaining of regurgitation of food and loss of weight. The patient had noticed the onset of dysphagia about twelve years previously, but periodic dilation with the Mosher dilator produced relief of symptoms. During the past two years, however, the dysphagia progressed in spite of dilations, there was frequent regurgitation of food and recently she had been unable to maintain her weight.

No abnormal findings were noted on physical examination. Her temperature was 99.4°F., pulse 88 and respirations 24. The blood pressure was 150 systolic and 88 diastolic.

Laboratory studies revealed the urine to have a specific gravity of 1.005 and the presence of 10 mg. of albumin per 100 cc.; the sediment was normal. The red count was 4,560,000 and the hemoglobin was 13.7 gm. per cent. The white cell count was 5,100 with a differential of 58 per cent neutrophils, 40 per cent lymphocytes and 2 per cent monocytes. The clotting time was three minutes and forty seconds and the bleeding time was one minute and forty seconds. The blood was type B, Rh positive. The serology was negative.

Roentgen examination of the chest was normal. Examination of the esophagus with barium revealed dilatation of the proximal esophagus with narrowing of the distal 2 cm. The lumen of the constricted area measured about 2 cm. Examination of the stomach and duodenum was negative as was the barium enema. Esophagoscopy revealed no evidence of tumor but the esophagoscope could not be passed into the stomach. Small bougies were passed with considerable difficulty.

In view of the progressive dysphagia of twelve years' duration and the inability to pass dilators, surgical relief of the obstruction was advised. Following operative preparation an esophagoplasty was performed on the fourth hospital day. At surgery no evidence of tumor could be found. The esophagus was found to be dilated except for an area of marked constriction just above the diaphragm. The Heller type of procedure was used during surgery. Blood, 1,000 cc., was given.

The patient made an uneventful recovery

and was discharged on the eleventh postoperative day free of symptoms and able to assimilate a regular diet. Within the first thirty days the patient gained 15 pounds in weight. When the patient was last seen, barium swallow revealed no evidence of obstruction; however, the esophagus was still dilated. The patient had been followed up for eleven months and was completely free of symptoms.

Comments. This case is typical of cardiospasm with dysphagia and regurgitation of food for many years symptomatically controlled by periodic dilation. However, with the passage of time cicatricial stenosis had formed and an organic obstruction developed which could no longer be relieved by peroral dilation. In the absence of lengthening and sagging of the esophagus such a case was ideal for the Heller operation through a transthoracic approach.

Case II. C. T., a forty-six year old married Negro woman, entered the hospital complaining of difficulty in swallowing. The patient had noticed the onset of dysphagia about one year before admission to the hospital. The dysphagia rapidly progressed during the last six months and for about one month before admission only liquids and small amounts of soft food could be swallowed. There had been frequent regurgitation of food; there had been no pain or weight loss. The history by systems was non-contributory.

On physical examination the chest was clear. The heart was apparently enlarged to the left. There was a soft systolic murmur at the base of the heart. No masses were palpated and there was no evidence of peripheral edema. Her temperature was 99°F., pulse 88 and respirations 18. The blood pressure was 220 systolic and 130 diastolic.

Laboratory examinations revealed the urine to have a specific gravity of 1.015, and were negative for albumin and sugar; there were occasional epithelial cells per high power field. The red cell count was 4,550,000 and the hemoglobin was 14 gm. per cent. The white cell count was 8,250 with a differential of 62 per cent neutrophils, 30 per cent lymphocytes, 4 per cent monocytes and 4 per cent eosinophils. The clotting time was three minutes and forty-three seconds and the bleeding time was one minute. The blood urea nitrogen was 18 mg. per 100 cc. The blood was type O, Rh positive. The serology was negative.

Fig. 4. Case II. Cardiospasm with demonstration of obstruction to barium at the esophagocardiac junction suggestive of malignancy; note the absence of any dilatation of the esophagus.

Roentgen examination of the chest revealed an enlarged cardiac shadow; the transverse cardiac diameter was 16 cm. with the transverse thoracic diameter being 25.5 cm. Examination of the esophagus with barium revealed an obstruction at the esophagocardiac junction. The esophagus was not dilated proximal to the obstruction. The obstruction was abrupt with only a trickle of barium passing through and was suggestive of a malignancy. (Fig. 4.) Examination of the stomach and duodenum was normal. A barium enema was normal.

Esophagoscopy revealed considerable esophagitis and mucosal edema of the distal esophagus. There was an obstruction just above the cardia but no tumor was visualized. However, there was a suggestion of ulceration in the friable mucosa in the obstructed area and a biopsy was taken. Microscopic examination of the biopsy revealed only chronic inflammatory tissue.

Due to inability to exclude a malignancy surgery was advised. After preoperative preparation an exploratory thoracotomy was performed on the fourth hospital day. At surgery a careful search for a tumor or metastases

was made but the only finding was a 3 cm. long area of constriction in the distal esophagus which was typical of cardiospasm with cicatricial stenosis. In view of the findings the Heller operation was performed. During the procedure 1,000 cc. of blood were given.

The patient made an uneventful recovery and was discharged the seventeenth hospital day free of symptoms. When last seen this woman had been followed up for six months and had no complaints. A recent barium swallow showed adequate esophageal lumen.

CASE III. N. S., a sixty-seven year old married white woman, entered the hospital complaining of difficulty in swallowing. The patient had noticed progressive dysphagia of one year's duration with almost complete inability to swallow at the time of admission. There had been frequent regurgitation of food and a weight loss of about 10 pounds.

Physical examination revealed the chest to be clear. The heart appeared normal in size and no murmurs were heard. No masses were palpated. Her temperature was 98.6°F., pulse 96 and respirations 20. The blood pressure was 110 systolic and 80 diastolic.

Laboratory examinations revealed the urine to have a specific gravity of 1.026, and the presence of 10 mg. albumin per 100 cc.; the sediment showed numerous squamous cells per high power field. The red cell count was 4,520,000 and the hemoglobin was 13.3 gm. per cent. The white cell count was 13,500 with a differential of 83 per cent neutrophils and 17 per cent lymphocytes. The clotting time was 3.5 minutes and the bleeding time was one minute. The blood was type O, Rh positive. The serology was negative.

Roentgen examination of the chest was normal. Examination of the esophagus with barium revealed almost complete obstruction to barium at the cardia with a moderately dilated esophagus above the obstruction. Examination of the stomach and duodenum were normal.

Esophagoscopy revealed a dilated esophagus filled with food and barium particles. An obstruction was present at the cardia but no tumor was noted. The mucous membrane was edematous and after thorough cleansing of the esophagus the area of obstruction was irrigated with saline which was aspirated in an attempt to obtain evidence of tumor cells if present. Microscopic examination of the aspirated material was negative for tumor cells. The Mosher dilator was passed with considerable difficulty but dilation was not satisfactory and there was very little relief of symptoms.

The provisional diagnosis was cardiospasm with early cicatricial stenosis; however, in view of the inability to exclude malignancy surgery was advised. After preoperative preparation an exploratory thoracotomy was performed on the sixth hospital day. At survey no evidence of tumor was found but a 3 cm. long area of constriction was present in the distal esophagus just above the diaphragm and the proximal esophagus was dilated. The findings were typical of cardiospasm and the Heller operation was performed. During the procedure the mucosa was entered so a small section was removed for biopsy and the defect was then repaired with interrupted fine silk sutures. During the operation 1,500 cc. of blood were given. Microscopic examination of the biopsy was negative.

The patient made an uneventful recovery and was discharged to the care of her private physician on the eighth postoperative day, with no complaints. When last seen she had been followed up for thirteen months and was completely free of symptoms. Barium swallow revealed no obstruction but there was still dilatation of the esophagus.

Comments. Cases II and III are examples of cardiospasm in which the differential diagnosis is quite difficult in excluding malignancy. Even though a tumor was not visualized preoperatively, the short progressive history and suspicious roentgen findings, especially Case II (Fig. 4), together with the inability to produce relief of symptoms of peroral dilation would seem to be justification for surgical exploration. The transthoracic approach allowed adequate exploration for exclusion of malignancy. These cases of cardiospasm with early cicatricial stenotic changes were ideal for the Heller operation and an excellent result was obtained.

CASE IV. J. E., a seventy-one year old married white man, entered the hospital complaining of difficulty in swallowing. He had been having difficulty in swallowing solid foods for sixteen years. During the past five years the dysphagia had progressed and only liquids and soft foods could be swallowed. One month before admission to the hospital it became necessary to take only liquids by mouth. There was

frequent regurgitation of food. During the past year there had been a weight loss of 40 pounds. In the family history, the man's father had had similar symptoms.

On physical examination there was evidence of marked weight loss. The chest was clear, there were no heart murmurs and the heart appeared normal in size. There was a small hydrocele on the right and a left indirect inguinal hernia. His temperature was 98°F., respirations 24 and pulse 96. The blood pressure was 140 systolic and 78 diastolic. The weight was 127 pounds.

The urine specific gravity was 1.027 and was negative for albumin and sugar; the sediment showed rare white cells per high power field. The red cell count was 5,060,000 and hemoglobin was 14.4 gm. per cent. The white cell count was 7,500 with 64 per cent neutrophils, 32 per cent lymphocytes and 4 per cent monocytes. The hematocrit was 44 and the sedimentation rate was .18 mm. per minute. The clotting time was 3 minutes and the bleeding time 3.5 minutes. The serum proteins were 5.6 gm. per 100 cc., with an albumin of 3.9 gm. and a globulin of 1.7 gm. The blood urea nitrogen was 15 mg. per 100 cc. The blood was type O, Rh positive. The serology was negative.

Roentgen examination of the chest was normal. Examination of the esophagus with barium revealed a large, dilated, flask-shaped esophagus with a marked obstruction in the lower 3 inches just above the diaphragm. Only a small trickle of barium passed through the obstructed area. Examination of the stomach and duodenum was negative as was a barium enema. A cholecystogram showed a non-visualized gallbladder.

Esophagoscopy revealed a dilated proximal esophagus with esophagitis and a marked obstruction at the cardia. No tumor was visualized. The esophagoscope was not passed through the cardia. Dilation was attempted with bougies but they were passed with considerable difficulty.

Due to the progressive history of sixteen years' duration and the difficulty of dilation surgery was advised despite the patients' age. He was prepared for surgery and on the sixth hospital day an operation was performed. At surgery the esophagus was found to be dilated and lengthened and a marked constriction was present just above the diaphragm. The constricted area was quite friable. No evidence of tumor was seen or palpated. In view of the lengthening and friable condition of the esophagus it was decided to resect the constricted area and perform an esophagogastrostomy. This was done without difficulty. During surgery and the postoperative hospitalization 2,000 cc. of blood were given. The patient made an uneventful recovery and was discharged the eighth postoperative day free of symptoms.

Microscopic examination of the resected area of constricted esophagus revealed thick, adult, stratified squamous epithelium with elongated rete pegs. There was moderate infiltration of lymphocytes and plasma cells in the underlying stroma and also thin-walled blood vessels filled with red cells. In a few areas there was a thin layer of hyperkeratinization. No evidence of malignancy was found. The pathologic diagnosis was leukoplakia, chronic inflammatory changes and telangiectasis.

When last seen the patient had been followed up eighteen months after surgery and was free of symptoms. Barium swallow revealed no obstruction at the esophagogastrostomy but some dilation of the esophagus was still present. The patient's weight was 140 pounds.

Comments. This case illustrates the type of cardiospasm not suitable for the Heller operation due to the marked dilatation, lengthening and sagging of the esophagus. Such a case is best treated with esophagogastrostomy, relieving the obstruction and also the lengthened esophagus. Also, the friable area of tissue was removed using more normal tissue for the anastomosis.

CASE V. H. B., a sixty-eight year old married white man, entered the hospital complaining of difficulty in swallowing. The patient had noticed progressive dysphagia of one year's duration and recently had been able to swallow only liquids. Occasionally there had been regurgitation of food. There had been no definite loss of weight and no pain.

Physical examination revealed the chest to be clear. The heart appeared normal in size and no murmurs were heard. No masses or lymph nodes were palpated. His temperature was 98.6°F., pulse 96 and respirations 24. The blood pressure was 140 systolic and 80 diastolic.

Laboratory studies revealed the urine to have a specific gravity of 1.025, and were negative for albumin and sugar. The sediment was normal. The red cell count was 5,450,000 and the hemoglobin was 16.7 gm. per cent. The white

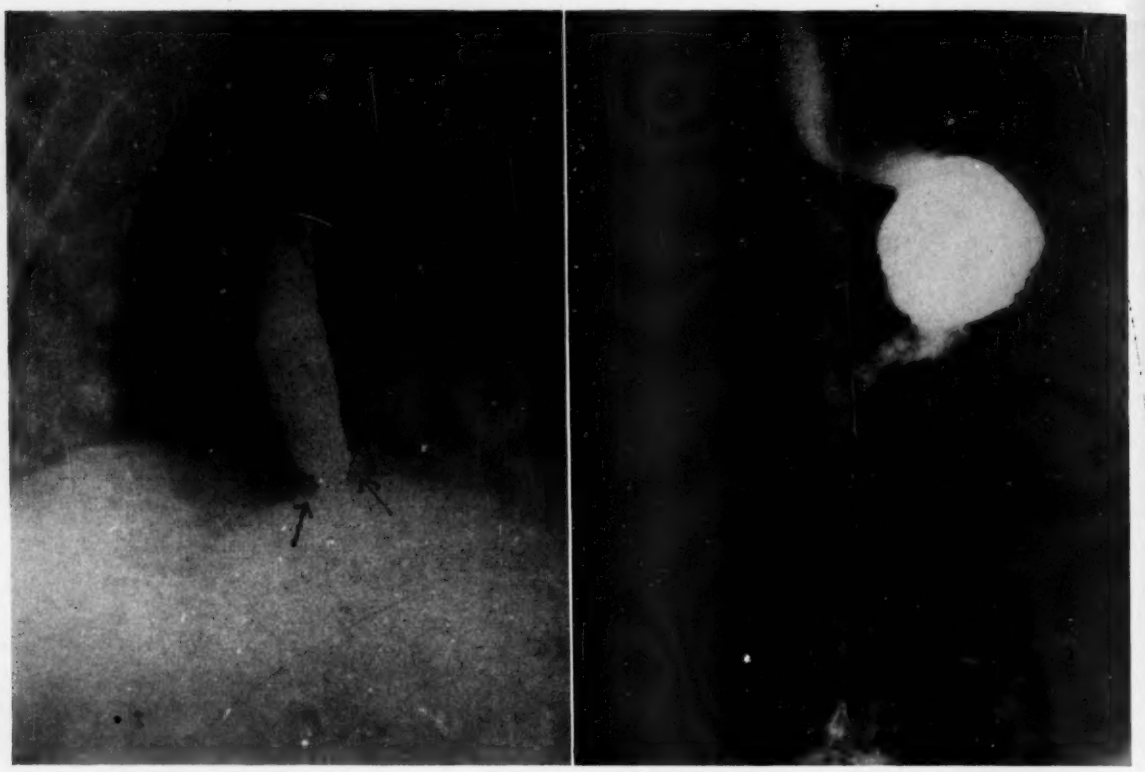

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FIG. 5. Case V. A, demonstration of obstruction to barium at the esophagocardiac junction with a dilated proximal esophagus; this case is typical of cardiospasm. Microscopic examination of resected area, however, revealed adenocarcinoma; B, postoperative film showing esophagogastrostomy.

cell count was 7,050 with a differential of 42 per cent neutrophils, 53 per cent lymphocytes, 4 per cent monocytes and 1 per cent eosinophils. The clotting time was 3.5 minutes and the bleeding time 1.5 minutes. The blood was type O, Rh positive. The serology was negative.

Roentgen examination of the chest was normal. Examination of the esophagus with barium revealed a marked constriction just above the diaphragm with moderate dilatation of the proximal esophagus. (Fig. 5.) Only a narrow lumen was present to allow the passage of barium and gastric mucosa was present just below the constricted area. The diagnosis by the roentgenologist was congenital shortened esophagus with cardiospasm. A cholecystogram was normal. Examination of the stomach and duodenum was negative. A barium enema revealed diverticulosis of the sigmoid colon.

Esophagoscopy revealed a normal mucous membrane and an area of constriction at the cardia but no evidence of tumor. Dilation was carried out with bougies and the Mosher dilator but there was very little relief of symptoms.

In view of the relatively short history, the difficulty of dilation and lack of relief surgery was advised. After the usual preparation for esophageal surgery an operation was performed on the fifteenth hospital day. At the time of operation a moderately dilated esophagus with an area of constriction above the diaphragm was found. On palpation the constricted area of the esophagus was nodular and very strongly suggested tumor formation. Therefore, an esophagectomy with partial resection of the stomach was effected, the stomach being freed in the usual manner and brought up through the diaphragm. No involved lymph nodes could be demonstrated and the liver appeared to be free of metastasis. The patient was supported with approximately 1,500 cc. of citrated blood. Convalescence was uneventful and the patient was discharged from the hospital on the fourteenth postoperative day feeling well and swallowing with ease.

The constricted area of the esophagus and stomach was 4 cm. long and 5 cm. in diameter. The mucosa was relatively friable and there were areas of leukoplakia with questionable ulceration. The wall of the esophagus measured

1 cm. thick and was fibrous and nodular on section. The gross specimen was very suggestive of malignancy and on microscopic section a small adenocarcinoma was found at the esophagogastric junction.

Comments. Although the relatively short history of this case was not typical of cardiospasm requiring surgical intervention, the roentgen examination and esophagoscopy were suggestive of a benign lesion. Surgery was advised due to the inability to relieve the symptoms by peroral dilatation. At surgery the constricted area was resected due to the suggestion of carcinoma on palpation. Such a lesion demonstrates the value of a transthoracic approach in the surgical treatment of all lesions in this area despite the fact that a positive biopsy was not obtained. Any thing less than radical resection would have been futile in this case.

REMARKS

The relief of symptoms in these patients subjected to surgery has been dramatic. The desired end result in cardiospasm is the production of adequate food passage and the promotion of comfort. The use of the Heller procedure through a transthoracic approach has fulfilled these requirements. The postoperative radiologic findings reveal continued dilatation of the proximal esophagus despite the fact that the clinical results have been excellent. A very small group of patients has been presented and I am aware of the fact that the time element has not been adequate for final conclusions; however, it is believed that the Heller operation has to this point given adequate relief of symptoms and has for its recommendation extreme ease of performance, an increased safety factor and freedom from morbidity. The operation should not be adapted to all cases of cardiospasm needing surgical treatment but may be applicable to the majority of them.

SUMMARY

1. The symptom complex known as cardiospasm has been briefly reviewed. While most of the patients with this condition can be treated using the peroral passage of dilators, from 2 to 5 per cent of the cases require surgical intervention.

2. The surgical procedure aimed at the cardia have been described.

3. The importance of the transthoracic approach has been emphasized. It offers adequate exposure of the esophagogastric junction, a more complete view of the actual pathologic condition is observed, thereby minimizing the danger of missing an early malignancy which might well be superimposed on an existing cardiospasm, and there is flexibility of choice of operation to be employed. The Heller procedure has for its recommendation extreme ease of performance, an increased safety factor, freedom from morbidity and has given adequate relief of symptoms.

4. Five cases of cardiospasm subjected to surgery have been presented; the transthoracic Heller type of esophagoplasty was used successfully in three of the five cases. The advantages of this procedure when used in selected cases are indicated.

5. In one case, representative of the type not suitable for the Heller esophagoplasty, an esophagogastrostomy was employed due to redundancy of the esophagus.

6. One patient whose condition was typical of cardiospasm no clinical findings was subjected to an esophagogastrectomy with esophagogastrostomy due to the suspicion of cancer at surgery. The surgical specimen was negative on gross examination but a small area of adenocarcinoma was found on microscopic examination. Such cases emphasize the added value of a transthoracic approach in the surgical treatment of all lesions in this area.

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HEMANGIOMA OF THE COLON*

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HEMANGIOMA is considered the rarest type of tumor occurring in the large bowel[3,13] and varies from a small vascular capillary nevus to a large cavernous type involving a considerable portion of the colon. They are probably congenital in origin and usually originate in the submucosa although five cases are recorded in which the hemangioma was subserosa.[1–3,7,9,15] Brown,[17] who collected a total of twenty cases of vascular tumors occurring below the stomach, found five of them to involve the large bowel. His classification of intestinal vascular tumors was as follows: (1) multiple tumors of the vascular arcades of either venous or arterial origin and microscopically either capillary or cavernous hemangiomas; (2) those arising in the submucosa and growing toward the lumen with possible ulceration and hemorrhage; (3) those arising in the submucosa and producing obstructive symptoms or intussusception by the attainment of great size; (4) the diffuse ring-like lesion which beginning in the submucosa involves the muscularis and constricts the lumen to produce obstruction.

The outstanding clinical feature of hemangiomas of the colon is hemorrhage from the bowel. This usually starts at an early age, due to the congenital nature of the tumor, and is persistent. Exacerbation and regressions of the bleeding may occur, but it usually becomes progressively worse and in earlier years was frequently fatal. Lockhart-Mummery[14] describes a case of cavernous hemangioma of the rectum with repeated hemorrhages leading to fatal termination[16] and reports two other similar cases. Intussusception has frequently been reported in pedunculated vascular tumors of the small bowel[5,9–11] but apparently does not occur in the colon. Buie and Swan[2] and Sawyer[12] report one case of obstructive annular hemangioma of the colon, with preoperative x-ray evidence of a filling defect.

TREATMENT

Only four cases have been reported in which surgical intervention was undertaken for a large bowel hemangioma. The first case was that of Buie and Swan[2,4] in 1929 who performed a Mikulicz type of resection for an obstructing annular hemangioma of the transverse colon just proximal to the splenic flexure. Preliminary colostomy had been established for an acute obstruction. In 1931 Bancroft[8] encountered a case very similar to the case reported herein in which a cavernous hemangioma involved the entire distribution of the superior hemorrhoidal vein. After dividing and exteriorizing the sigmoid he injected 10 cc. of 40 per cent sodium salicylate into the divided distal end of the superior hemorrhoidal vein. No further bleeding occurred and the mucosal varices were obliterated. Eleven months later the colostomy was closed and follow-ups revealed no recurrence of rectal bleeding. Sawyer[12] in 1939 performed a Mikulicz resection of the sigmoid for an annular obstructing hemangioma, cavernous in type. In 1941 Hunt[1] reported a resection of the rectum and rectosigmoid by the Lahey two-stage modification of the Miles operation. The diagnosis was "cavernous hemangioma of the rectum and rectosigmoid, involving the pelvic peritoneum and serous coat of the distal half of the uterus." Recovery was uneventful. Until 1929 the treatment of these lesions was by cauterization, which was both unsatisfactory and dangerous, or by various types of colonic instillations. These procedures were accompanied by a 50 per cent mortality, usually from continued or recurrent massive hemorrhages. In the light of present knowledge it seems that extensive hemangiomas of the large bowel producing recurrent hemorrhage, anemia and the threat of sudden disaster should be treated with radical extirpation of the involved segment.

CASE REPORT

E. W. G., a seventeen year old white student, was admitted to Temple University Hospital on the service of the senior author on June 11, 1948, with the chief complaint of rectal bleeding, intermittent since birth.

The patient had been known to have chronic melena since birth, the bleeding usually occur-

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ring with bowel movements; however, not infrequently pure blood would be passed alone. Two months prior to admission the patient had experienced an exsanguinating hemorrhage for which he was admitted to his local hospital and given multiple transfusions. Barium enema revealed an irregularity which was interpreted as an extrinsic lesion of the rectum. On April 27, 1949, an exploratory laparotomy disclosed an obvious malrotation of the colon with the cecum high in the right upper quadrant. There was extensive telangiectasia of the distribution of the inferior mesenteric vein involving apparently the entire sigmoid and rectum. The bladder appeared to be full although the patient had voided before operation and on catheterization immediately after operation no urine was obtained. The appendix was removed and due to lack of preparation of the patient for large bowel surgery the abdomen was closed. The patient made an uneventful recovery except for persistent rectal bleeding and on June 8, 1948, was referred to one of us (W. W. B.) for definitive treatment. Resection of the involved bowel was advised and the patient was placed on sulfasuxidine and non-residue diet before entering the hospital.

The past history revealed that in 1931 a lipoma was removed from the patient's left leg. A lipoma was removed from his buttock in 1934, one from his left leg in 1941 and again one from his buttock in 1946. He underwent a laparotomy and appendectomy (as described) in April, 1948. The patient had had the usual childhood diseases plus pneumonia in infancy. The systemic review was essentially negative.

On physical examination a rather poorly developed, thin, young white male was seen who was in no acute distress. He was rather pallid in appearance and of the asthenic type. He was 5 feet, 10 inches in height and weighed 129½ pounds. His temperature was 98.6°F., pulse 100, respirations 20 and blood pressure 126/86. The patient wore glasses. His pupils were regular, active and equal. He had good oral hygiene and the pharynx was normal. There was no adenopathy of the neck and the thyroid was not enlarged. The trachea was in the midline. The chest was symmetrical and the lungs clear and resonant. There was normal sinus rhythm of the heart, with no murmurs. Examination of the abdomen revealed a recent lower abdominal midline incision with a granulating area at the lower angle of the wound. The liver and spleen were not enlarged and there were no abdominal masses. No masses were felt in the rectum. There was a papillomatous ridge in the midline between the coccyx and anus. There were scars on both buttocks and two scars on the left thigh. Verruca acuminata extended over the perineal and coccygeal area. On proctoscopic examination June 8, 1948, the proctoscope was passed to 24 cm. The rectal mucosa was reddened and engorged but no fresh blood was seen. There was no new growth or ulceration and no excess of mucus.

Accessory clinical findings were as follows: Hemoglobin, 13.2 gm., 85.8 per cent of normal; red blood cells, 4,580,000; color index, 0.94; white blood cells, 3,000; polymorphonuclears, 45 per cent; lymphocytes, 41 per cent; monocytes, 8 per cent; eosinophiles, 5 per cent; basophiles, 1 per cent. No marked anisocytosis, poikilocytosis or achromia was noted. The serum protein was 8.0 gm. per cent and the blood urea nitrogen was 13 mg. per cent. The urine was clear; specific gravity was 1.015 and the pH 6.0. The urine was negative for albumin, sugar, blood and cells. The Kolmer, Kahn and Mazzini serologic tests were negative. A photofluoroscopic chest film was reported essentially negative.

The patient was continued on sulfasuxidine and the colon emptied by laxatives and enemas. On June 14, 1948, the patient underwent surgery.

Operation was performed under spinal anesthesia produced by intradural injection of 9 mg. of pontocaine and 100 mg. of procaine in the first lumbar interspace. The small sinus at the lower end of the scar was sterilized with 10 per cent solution of zinc chloride and delineated with 3.5 per cent tincture of iodine. A continuous intravenous drip of 5 per cent glucose solution followed with 1,000 cc. of typed blood was used throughout the operation. The abdomen was opened by a narrow elliptical incision with excision of the old scar and of the iodized tissue about the depth of the small sinus. The abdomen was free of adhesions except for one or two small omental attachments which were divided. No abnormality was felt in the region of the liver, gallbladder, spleen, kidneys or pancreas. Lying in the open incision was the rather large and moderately distended sigmoid covered by a mesh of dark bluish vessels which elevated the serous coat and largely surrounded the sigmoid. (Fig. 1.) Along

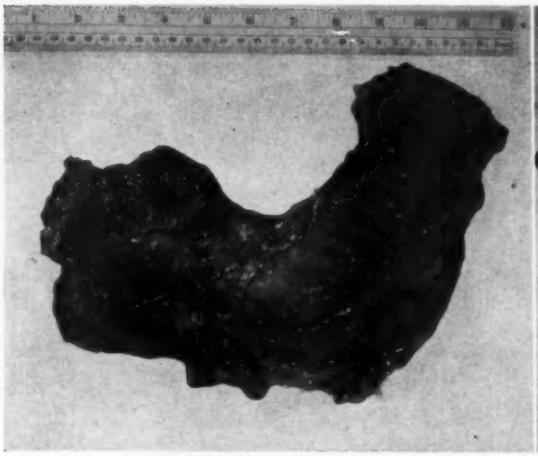
FIG. 1. Operative photograph showing the mobilized sigmoid with the dilated tortuous varices.

the left side under the left leaflet of the sigmoid was a 3 by 6 cm. mass of blood vessels, also compressible and not pulsating, lying lateral and slightly posterior to the left. The angiomatous blood vessels covering the sigmoid did not extend into the lateral peritoneal leaflets nor did they occupy the mesentery of the sigmoid.

The small intestine and great omentum were displaced from the lower abdomen and pelvis by wet gauze packs. Dividing the rectovesical peritoneal reflection the plexus of enlarged vessels about the rectum was found to be thicker than that about the sigmoid and to extend to below the upper level of the pelvic floor. The seminal vesicles lay in the mass of convoluted vessels but were not adherent or involved. It was evident that to eradicate the angiomatous mass it would be necessary to remove the lower half of the sigmoid together with the rectum to the sphincters.

The left lateral leaflets of the sigmoid were divided, the left ureter identified by its trombone-like peristaltic waves, and displaced from the peritoneum to the left and well into the pelvis. The hand was introduced under the sigmoid which with the rectum was separated from the lower spine and from the sacrum and from its attachment at the sacrococcygeal articulation. The right peritoneal reflection was divided parallel with the sigmoid and the superior hemorrhoidal and inferior mesenteric vessels divided and doubly ligated opposite the body of the third lumbar vertebra. From the point of vascular division the mesosigmoid was divided to the mid-portion of the sigmoid about 3 cm. above the angiomatous bowel, taking care to make the division between the main vascular arcades and tying each of the small vessels divided with fine silk or catgut. The rectum and its vascular layer were freed from the vesicles and prostate to the pelvic floor, and the lateral ligaments of the rectum with the mid-colic arteries divided. The vessels did not require ligation and there was no serious hemorrhage. One small vein oozing over the mid-sacrum was occluded by a suture ligature. A folded soft gauze tape was tied as a guide about the sigmoid and the ends packed against the floor of the pelvis. This indicated the lowest level of vascularity of the sigmoid and the packing served to reduce any oozing from pelvic surfaces. A 10 mm. sump drain was introduced through the incision along the left side of the sigmoid to the pelvic floor. This was at once connected to an aspirating pump. The wound was accurately closed about the sump drain with a deep row of closely placed interrupted sutures of No. 32 alloy steel wire tied in a square knot and the ends cut off as close as possible to the knot to eliminate sharp irritating wire ends in the wound. This first row united the peritoneum and deep layer of the rectus. A second row of the much stronger No. 30 wire interrupted sutures united the sheath and more superficial muscular layer of the recti. The skin and fat were united with interrupted sutures of No. 32 wire and the skin edges approximated with a continuous suture of No. 35 stainless steel wire.

With the patient in the lithotomy position the rectum was first carefully wiped out with pledgets of gauze wet with 3.5 per cent tincture of iodine, after which the lower rectum was packed with a long strip of gauze wet with the tincture of iodine to block any contamination from above and to dry and arrest secretion from the glands of the mucous membrane. A midline incision was made through the posterior portion of the anus, sphincters and median raphe of the perineum to the base of the coccyx. The incision was then deepened along the right side of the coccyx through the pelvic floor and the halves of the levator ani separated by an incision in the midline through the pelvic floor. The terminal rectum was then divided by curved scissors just above the divided sphincters posteriorly, and as it was divided the upper or rectal end was grasped by a succession of hemostatic forceps until the division was complete. Retracting the sides of the wound with an abdominal retractor the finger was passed back of the rectum into the pelvis,



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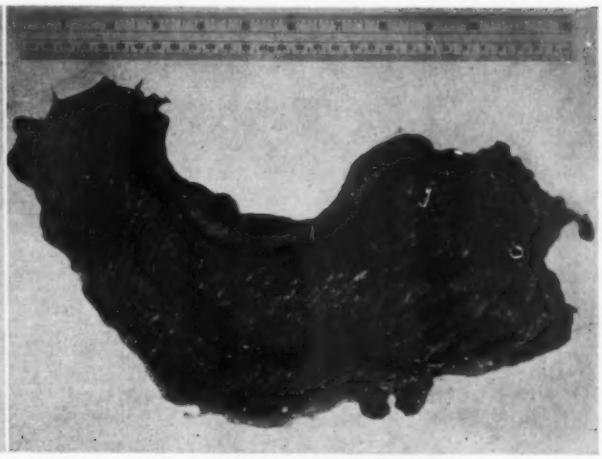

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FIG. 2. Serosal view operative specimen; most of the subserosal varices have collapsed.
FIG. 3. Mucosal view operative specimen; in addition to the mucosal engorgement note the desiccating action of tincture of iodine on the mucosa of the lower rectum.

hooked first on one side then the other as the halves of the levator were cut from the rectum. With traction on the rectum the lateral attachments were divided and finally the anterior attachment to urethra and prostate, taking care not to invade these structures by working in the avascular layer close to the bowel. The rectum now liberated was withdrawn with the lower sigmoid with the attached tape of folded gauze, which showed the lowest vascularized level of the sigmoid. In this case this level came to about 6 cm. below the perineum. The withdrawn rectosigmoid was wrapped in a towel and laid upon the abdominal wall out of the way. With a trowel-shaped retractor the section of sigmoid in the pelvis was elevated, enabling the pelvic cavity to be wiped out and examined for bleeding points.

The pelvic floor was then closed in layers with interrupted sutures of No. 32 wire to approximate the halves of the levator muscle and the more superficial tissues in about four layers. The divided anal sphincter was not united to avoid constriction of the withdrawn bowel. The protruding bowel was divided beyond the skin and a short dumbell-shaped glass vent tube was tied in with a strong ligature to prevent secondary bleeding from the end of the divided bowel while the glass tube provided a vent for escape of gas or other intestinal contents. The protruded intestine was dusted with boric acid powder and wrapped in sterile gauze so that its moist outer surface would not lie against the thighs. Dressings were then applied.

The pathologic report revealed the following:

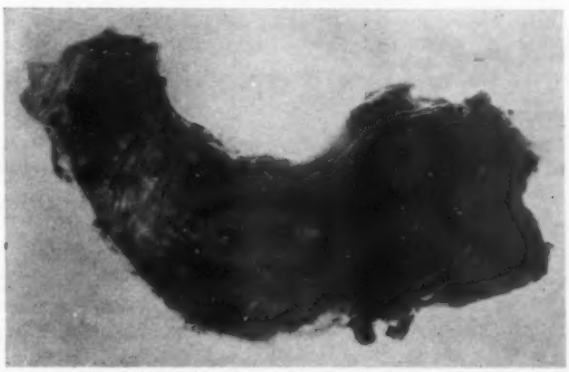
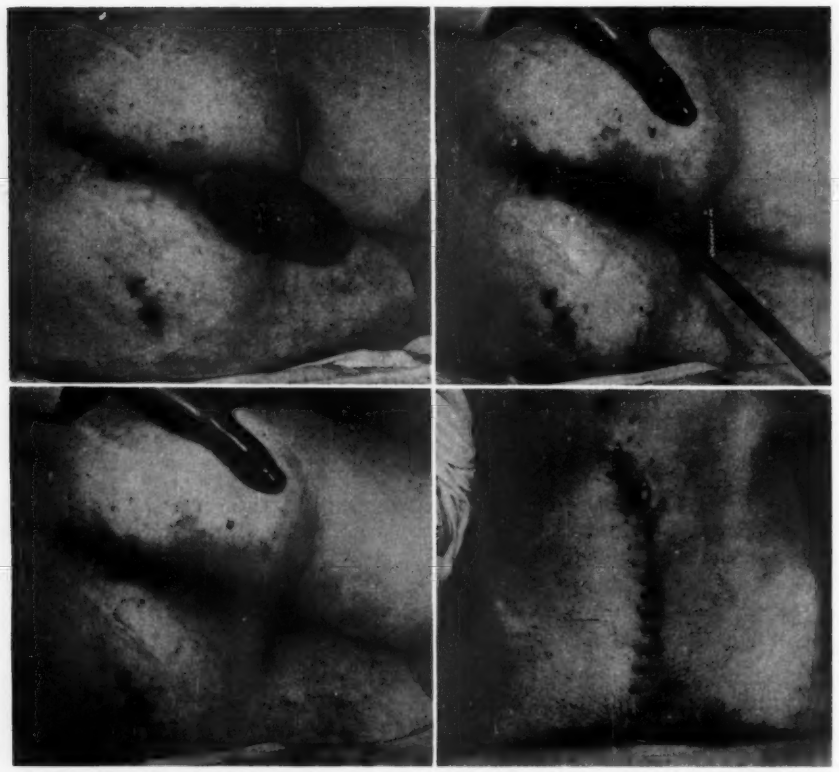


FIG. 4. Transillumination of operative specimen showing extensive involvement, especially in the rectal ampulla.

Grossly, the specimen consisted of a segment of large bowel 32 cm. in length. It was opened to expose the mucosal surface which for almost its entire length was characterized by the presence of many elongated, tortuous and dilated submucosal venous channels. Similar structures were noted in the subserosal area. In addition the mucosal surface presented a fine nodularity. The attached mesenteric tissues contained no significant alteration. (Figs. 2 to 4.)

Microscopically, these sections were featured by the occurrence of widely dilated and engorged vascular channels. They were situated within the submucosal and serosal regions. The structures were seen singly or in clusters of three or four cavernous sinuses with thin septal walls. No budding vessels were noted. The muscular layers disclosed no significant change. The mucosal coat was not ulcerated nor did it contain any noteworthy changes.



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7 8

FIG. 5. The perineal wound and protruding bowel stump as it appeared on ninth postoperative day.

FIG. 6. Taken fifteen minutes after Figure 2; the protruding bowel has been amputated by a tonsil snare over the inserted rectal tube; the bowel end now unites spontaneously with the mucosa of the anal canal.

FIG. 7. The anal opening with the rectal tube removed; note the verruca acuminata of the perineum which may have been produced by the continual presence of blood in this area.

FIG. 8. The abdominal wound on the ninth postoperative day; note lack of irritation around the stainless steel wire sutures in spite of the wound infection present postoperatively.

9 10

FIG. 9. Perineum thirteen months postoperatively; note that the perineum is almost completely free of the verrucous lesions, thus supporting the previous hypothesis.

FIG. 10. Abdomen thirteen months postoperatively.

The diagnosis was hemangioma of the rectosigmoid.

The patient tolerated operation quite well. His temperature did not rise above 100°F. the first six postoperative days. The sump drain was removed on the third postoperative day. The Foley catheter was removed on the fourth postoperative day but the patient did not void spontaneously until the seventh postoperative day, requiring several catheterizations. On that day he began to run a spiking febrile course, the cause of which could not be determined. It gradually cleared by lysis. The protruding bowel stump remained viable and was removed on the ninth postoperative day. (Figs. 5 to 8.) The patient was discharged on July 3, 1948, nineteen days postoperatively, with both wounds well healed, moderate function of the anal sphincters and partial fecal continence.

The patient was last seen on July 19, 1949, thirteen months after operation, at which time he was found to be in excellent health and had experienced no recurrence of the rectal bleeding. He had gained 15 pounds over his preoperative weight. He had excellent bowel function and complete fecal continence. He wore no pad or perineal dressing. Sphincter action was normal and of good tone. (Figs. 9 and 10.)

COMMENT

Hemangioma of the large bowel is a rare lesion. Only three cases in which treatment was by surgical excision are reported in the literature. Two of these, one case an annular obstructing hemangioma of the distal transverse colon and the other a similar lesion in the sigmoid) were removed by Mikulicz resection. The third case, apparently quite similar to the case reported herein, was removed by the Lahey two-stage modification of the Miles technic. This is believed to be the first case reported of surgical extirpation of an extensive hemangioma of the colon by a one-stage abdominoperineal proctosigmoidectomy, with preservation of the anal sphincter and retention of a functional anus.

SUMMARY

The literature dealing with hemangioma of the large bowel is reviewed and an additional case reported.

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SUBMUCOUS LIPOMA OF THE LARGE BOWEL*

CASE REPORT WITH REVIEW OF THE LITERATURE

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SUBMUCOUS lipoma of the large bowel and rectum although relatively rare occurs with sufficient frequency and should be given due consideration when one is confronted with a diagnostic problem in the large bowel. The literature was reviewed up to 1941 by Stetten,[1] Comfort,[2] Pemberton and McCormack,[3] and Gault and Kaplan,[4] These authors reported a total of 130 cases. Since 1941 a total of twenty-one cases has been reported. These cases plus that reported in this article comprise a total of 152 case reports of submucous lipoma of the large bowel.

Submucous lipoma of the large bowel is most frequently confused with carcinoma. It is seen generally during the cancer age. In the series presented the average was fifty-two years. The oldest patient was seventy-five years and the youngest twenty-five years of age. The condition seems to occur more frequently in women. In this series there were fourteen cases in women and eight in men. Pemberton and McCormack report the average age to be 47.5 years in patients with symptoms and 63 years in those patients without symptoms. In this latter series sixty-two patients were women and forty-one were men. The remaining number was not given.

In a tabulation of symptoms in this series pain was the predominant symptom; the next most frequent symptom was constipation. The symptoms occurring in this series in their order of frequency are as follows: pain, fifteen cases; constipation, eleven; diarrhea, eight; blood (gross or microscopic) in stool, eight; weight loss, eight; nausea, seven; gas, seven; vomiting, five; tenesmus, three; anorexia, two and chills, one. These symptoms are similar to those reported by Pemberton and McCormack. They report pain, constipation, blood in stool, diarrhea, weight loss and anemia in that order of frequency. Gault and Kaplan do not report any cases with weight loss in their series. Constipation and blood in the stool are their most frequent findings.

In this series of cases the most frequent location was found to be in the transverse colon, with eight cases showing the lesion in this area. Location of the tumors in order of frequency in this series is as follows: transverse colon, eight cases; cecum, three; descending colon, three; sigmoid, three; ascending colon, two; splenic flexure, two and hepatic flexure, one. In Gault and Kaplan's report the tumor was found in the following locations: cecum, four; transverse colon, three; splenic flexure, two; ascending colon, two; rectum, two and multiple, one. In Pemberton and McCormack's report the tumor was found in the following locations: cecum, twenty-nine; ascending colon; twenty-one; transverse colon, fifteen; sigmoid flexure, fourteen; rectum, twelve; descending colon, ten; colon (exact location not reported), ten; probably colon, two and possibly colon, two.

The various operative procedures in this series are as follows: tumor expelled spontaneously from rectum, one case; right hemicolectomy, four; local excision of tumor without resection, three; resection of tumor-bearing area, five; exteriorization of tumor mass, one; obstructive resection, three; Mickulicz resection, two, abdominoperineal resection, one; cecostomy, four and colostomy, one. It is to be noted that a decompression operation was required in five cases. In one case the tumor was expelled spontaneously from the rectum. The operative procedures were of a radical nature in all except three cases. In these latter cases a diagnosis of benign tumor was made, the colon opened and the tumor excised. This indicates the difficulty in differentiating this benign lesion from a malignant neoplasm. Submucous lipoma of the colon occurs in the cancer age as indicated by the average age in this series of fifty-two years. The absence of

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weight loss is considered a good indication that the tumor is benign. However, in this group there were eight patients who had some weight loss prior to operative procedure. In Cases VIII and IX the lipoma was an incidental finding secondary to malignancy in another part of the colon. Intussusception was reported in four of the twenty-two cases. This is a rather low incidence and is certainly not characteristic of the condition. When it does occur in the age group previously cited, certainly a benign neoplasm must be considered as a causative factor in lesions of the large bowel. A significant finding in the history is the relatively long duration of symptoms. Pemberton and McCormack report that the average duration of symptoms was 41.5 months.

In Gault and Kaplan's report resection of the tumor-bearing area was the operation of choice. This was also true in Pemberton and McCormack's report. It is interesting to note that the tumor mass passed spontaneously in eleven cases in the latter's report. In the cases being reported in this paper one patient had a spontaneous passage of the tumor with ultimate recovery. Table 1 is a summary of case reports found in the literature since the publication of Gault and Kaplan in 1941. In the series being reported here eighteen of twenty-two cases had positive x-ray findings. Gault and Kaplan showed eight of fourteen cases. Pemberton and McCormack reported eighteen in ninety-four cases. The latter's report reviews the early cases reported and this indicates the relative infrequency of x-ray examinations.

TABLE 1

Authors	Sex	Age (yr.)	Location	Operative Procedure
Mannheim and Peskin[5]	Female	47	Mid-sigmoid	Expelled spontaneously
Browne and McHardy[6]	Female	75	Cecum	Hemicolectomy, right
Runyeon[7]	Female	59	Transverse colon	Local excision
Runyeon[7]	Female	52	Descending colon	Local excision
Case No. 27042 (Cabot)[8]	Female	49	Transverse colon	Hemicolectomy, right
Barnes and Barnes[9]	Female	48	Splenic flexure	Resection
Saint[10]	Male		Ascending colon	Hemicolectomy, right
Schottenfeld[11]	Male	48	Transverse colon	Resection
Schottenfeld[11]	Female	44	Transverse colon	Autopsy finding
Schottenfeld[11]	Female	55	Ascending colon	Autopsy finding
Pack[12]	Male	41	Cecum	Resection
Pack[12]	Male	54	Hepatic flexure	Resection
Moore[13]	Female	36	Cecum	Right hemicolectomy
Bradley[14]	Male	41	Descending colon	Local excision
Mason and Linn[15]	Female	65	Splenic flexure	Resection
Lazarus and Marks[16]	Female	65	Transverse colon	Resection
Schorr and Erlik[17]	Male	52	Sigmoid	Abdominoperinial resection
Garat[18]	Female	60	Transverse colon	Left hemicolectomy
Spatolisano[19]	Male	26	Descending colon	Resection
Cabot (22452)[20]	Female	55	Transverse colon	Resection
Ravenel[21]	Female	60	Transverse colon	Resection

CASE REPORT

J. W. J., a white male aged sixty-six, was admitted to the DeCourcy Clinic September 5, 1947, with the chief complaint of rectal bleeding of three months' duration. The bleeding was of a bright red and also a dark red character. He stated that he had always been constipated and had to resort to the use of laxatives frequently. He gave no history of abdominal pain or distention. However, he stated that there was a feeling of constriction or tightness in the left lower abdominal quadrant. He believed that the circumference of the stool might have been smaller since the onset of the bleeding. There was no loss of weight.

The past history was essentially negative. His father and mother were both dead; the cause of death was unknown. He had three

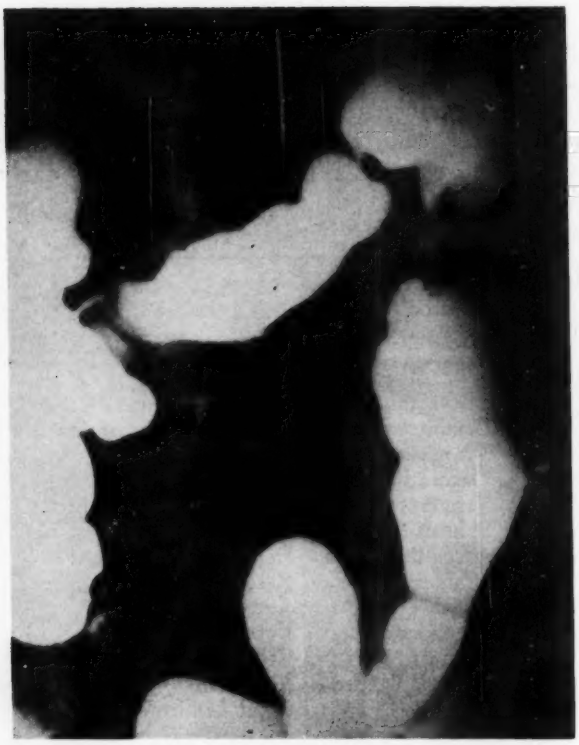

FIG. 1. X-ray of the colon with barium enema demonstrating the filling defect in the descending colon immediately distal to the splenic flexure.

FIG. 2. Gross specimen showing the pedunculated tumor mass extending into the lumen of the bowel.

sisters and three brothers, all of whom were living and well. He had seven children living and well. At the age of twenty-six years he had had a fistulectomy.

Physical examination revealed a well developed thin white male who appeared to be approximately his chronologic age. His temperature was 98.6°F., pulse 90 and respiration 20. The blood pressure was systolic 165 and diastolic 100. The physical findings showed that the heart was enlarged, slightly downward and to the left. The abdomen was slightly distended and there was a questionable mass on the left side of the abdomen at the level of the umbilicus. There was no abdominal tenderness to palpation. The proctoscopic examination was negative.

Laboratory procedures showed the following: hemoglobin, 83 per cent; red blood cells, 4,800,000; white blood count, 7,100; polymorphonuclears, 67 per cent; lymphocytes, 32 per cent; mononuclears, 1 per cent; stabs, 4 per cent. Urinalysis: urine was yellow and clear; specific gravity, 1.015; reaction, acid; sugar, negative; albumin, negative. There were 35 to 40 white blood cells and an occasional red blood cell per high power field. The fasting blood sugar was 83 mg. X-rays of the gastrointestinal tract showed the following positive findings: "Examination of the colon by means of barium enema reveals a defect just beyond the splenic flexure of the colon in the descending portion. The defect measures 5 centimeters in length with its lower portion constricting and annular in type. Above this the colon shows irregular filling which may be fecal material. Impression: Carcinoma, descending colon." (Fig. 1.)

The patient was admitted to the Good Samaritan Hospital September 12, 1947. A repeat x-ray of the colon revealed the same findings in the descending colon as just described. The patient was placed on a regimen for a large bowel resection. This consisted of 1 ounce of magnesium sulfate daily for three days. A saline enema was given daily after the laxative had acted. Sulfaguanidine was used in the following dosage: 60 gr. every four hours for six doses, then 30 gr. every four hours with the last dose being given six hours preoperatively. The patient was placed on a low residue, high carbohydrate diet. He was typed and cross matched, and blood was made available for the time of operation.

The patient was operated upon September 17, 1947. Under general anesthesia, nitrous oxide-ether, a pararectus incision was made along the lateral border of the left rectus muscle. The abdomen was opened and a tumor mass was located in the descending colon just distal to the splenic flexure. The tumor mass was freely movable within the

lumen of the bowel and seemed to be attached to the bowel with a pedicle. The descending colon was mobilized and a resection of the colon containing the tumor mass was performed. The proximal and distal ends of open bowel were approximated with an end-to-end anastomosis. The abdomen was closed in layers, with a rubber tissue drain inserted down to the suture line and brought out through the lower end of the incision. Following this a caecostomy was performed through a McBurney incision.

Immediately postoperatively the patient was given 500 cc. of whole blood. A Levine tube was inserted into the stomach and a Wangensteen suction tube instituted. The tube was left in place for four days during which time the patient was fed parenterally. After the tube was removed, the patient was fed a liquid diet on the fifth postoperative day, soft diet on the sixth and seventh days and a general diet thereafter. The patient was given 50,000 units of penicillin intramuscularly every four hours for ten days following the operative procedure. Five per cent sulfadiazine, 30 cc., was given intravenously for eight days postoperatively. The patient's first bowel movement occurred on the tenth day following the operation. The cecostomy tube was removed on the fourteenth postoperative day. The patient was dismissed from the hospital on his eighteenth postoperative day. He was seen on three occasions within six months following the operation and has felt fine on each visit to the Clinic.

The pathologic report stated: "The gross specimen consists of a segment of large intestine 10 centimeters long, at one extremity of which there is a pedunculated mass 7 × 4 × 3 centimeters. The entire mass is covered by an intact mucosa with the exception of a small area near the tip which projects further into the lumen. The base of the mass is in the intestinal wall along the mesenteric border and on cut section the mass consisted of an encapsulated fatty tumor. There is no invasion of the wall beneath the base of the tumor." (Fig. 2.)

The microscopic report stated: "The sections show a well developed fatty tissue tumor arising in the submucosa of the large intestine pushing the mucosa forward in the polypoid fashion. The tip of this mass is ulcerated and necrotic. The remaining mucosa shows chronic inflammation. Diagnosis: Submucous lipoma of large intestine." (Fig. 3.)

FIG. 3. Microscopic section through entire thickness of tumor mass showing a submucous lipoma of the large bowel.

SUMMARY

1. A case of a submucous lipoma of the large bowel is reported.

3. A review of the literature has been made, and a presentation of cases found since the publication of Pemberton and McCormack in 1937 and Gault and Kaplan in 1941 is submitted.

3. A total of 152 cases of submucous lipoma have been reported in the literature.

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Twenty patients with advanced cancer of the breast were recently treated with large doses of testosterone. A few were definitely helped; the rest showed only slight improvement, if any at all. In all cases recurrences developed later. Testosterone administration is accompanied with increases in the retention of potassium, sodium and protein nitrogen, with resultant increase in water retention, a dangerous condition to induce in cardiacs. Besides, over 200 mg. of this hormone per month (by injections) may cause masculinization. For these reasons, and because either surgical or roentgen castration produces similar results, many authorities now believe that we should dispense with testosterone therapy altogether in advanced cancers of the breast. (*Richard A. Leonardo, M.D.*)

CARCINOMA OF THE COLON*

SELECTION OF THE OPERATIVE PROCEDURE

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THE present trend toward resection and primary anastomosis in the management of carcinoma of the colon has caused this phase of treatment to overshadow other aspects of the problem. McFee[18] and Graham[9] have expressed a note of caution over the wholesale adoption of this method. Recent historical reviews by McFee,[18] Hinton and Localio,[11] and McKittrick[19] make repetition at this time unnecessary.

Objection to obstructive resection on the basis of inadequacy as a cancer operation is not borne out by the results of Cattell[4] and Jones.[13] Mortality rates reported by Lahey[16] and Jones[13] compare favorably with those of resection and primary anastomosis. The advantages generally conceded to resection and primary anastomosis are the elimination of staged procedures, avoidance of temporary colostomy and decreased wound morbidity. McFee,[18] and Hoxworth and Mithoefer[12] have emphasized that the latter method requires more exacting attention to preparation of the patient and strict adherence to the optimum conditions for anastomosis. Some surgeons have used intraperitoneal anastomosis only for lesions of the right colon and performed exteriorizing procedures on the left colon. Selection of procedure for different portions of the bowel have been based on the physical character of the bowel content.

Despite the mortality decrease ascribed to improved anesthesia, chemotherapy, antibiotics, blood replacement and better technic, the value or necessity of proximal vents in the absence of obstruction has not been determined. Similarly the ultimate role of the long tube as a safety measure has yet to be thoroughly evaluated.

This paper reviews eighty-nine consecutive resections of the colon for carcinoma from the standpoint of selection of the operative procedure. Late results will not be considered. These patients were operated upon by the writers during the six-year period 1943 to 1948, inclusive. These comprise a homogeneous group as all were prepared, operated upon and managed postoperatively according to the same plan. Lesions from the cecum to the rectosigmoid only are included. There were sixteen patients on whom operation was not performed because of generalized metastases or the procedure limited to exploration only, giving a resectability rate of 82.1 per cent. Sphincter-saving operations for rectal carcinoma are purposely excluded. There were fourteen lesions of the right half of the colon and seventy-five of the left half.

As one reads the literature it becomes obvious that common terms are used differently by various authors. To avoid possible confusion the following terminology will be adhered to in the description of operative procedures: (1) One-stage resection and immediate anastomosis; (2) preliminary decompressive vent followed by resection and anastomosis; (3) resection and anastomosis with complementary decompressive vent; (4) obstructive resection with delayed anastomoses extraperitoneally or intraperitoneally.

Preparation. At least five days have been used for preoperative preparation. Succinyl sulfathiazole has been used during this period to diminish the bacterial content of the bowel. Three grams have been given at four-hour intervals without cathartics or enemas as recommended by Poth and Knotts.[22] In addition to reducing the bacterial content of the stool and furthering primary union of the bowel as shown by Poth et al.,[23] we have observed the correction of incomplete obstructions previously described by Allen.[1] The last feature has led us to place patients with carcinoma of the left colon on this drug as soon as the diagnosis is made. Patients recovering from procedures to relieve acute large bowel obstruction are given the drug as soon as oral fluids are tolerated. Protein depletion has been corrected with intravenous hydrolysate preparations and oral

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protein concentrates. Whole blood transfusion has supplemented this therapy and corrected anemia prior to operation. Parenteral vitamin C has been given during preparation. Vitamin B and K deficiencies have been described secondary to succinyl sulfathiazole usage by

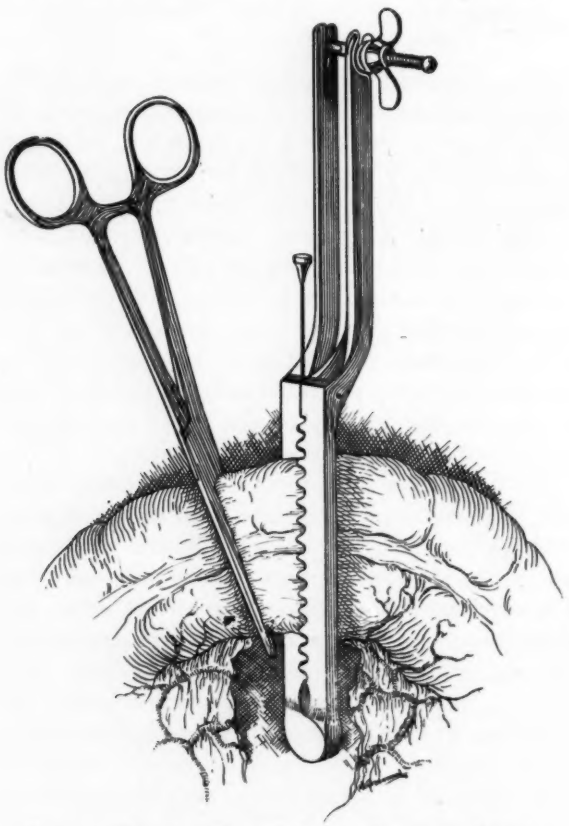


FIG. 1. Closed end-to-end ileocolostomy; Furniss clamp applied to transverse colon.

Najjar and Holt,[21] Kornberg et al.[15] and Black et al.[3] These vitamins have also been given parenterally during preparation. No hemorrhagic tendency has been encountered with succinyl sulfathiazole similar to that reported by Firor,[7] Allen,[1] and Saunders.[25]

Technical Considerations. Resection and primary anastomosis has been the procedure of choice. Transverse incisions were used for growths in the abdomen proper while the Cherney[5] incision was used for lesions of the sigmoid when low anastomosis was necessary. Only four patients were operated upon through vertical incisions. After wide excision of growth and zone of lymphatic spread in the mesocolon, continuity has been reestablished by closed end-to-end anastomosis using the Furniss[8] clamp. (Figs. 1 to 7.) End-to-end anastomosis is suitable for restoration for continuity in all parts of the colon including resections of the right colon previously shown by Mayo and Schlicke.[17] After clearance of epiploic appendages and mesenteric fat for a distance of 5 to 7 mm. as advised by Wangensteen[26] the bowel

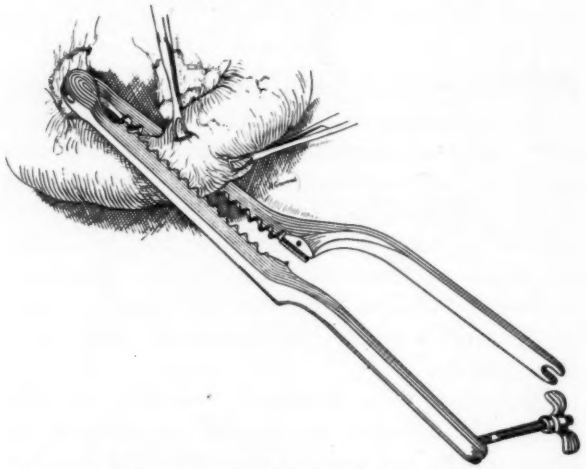
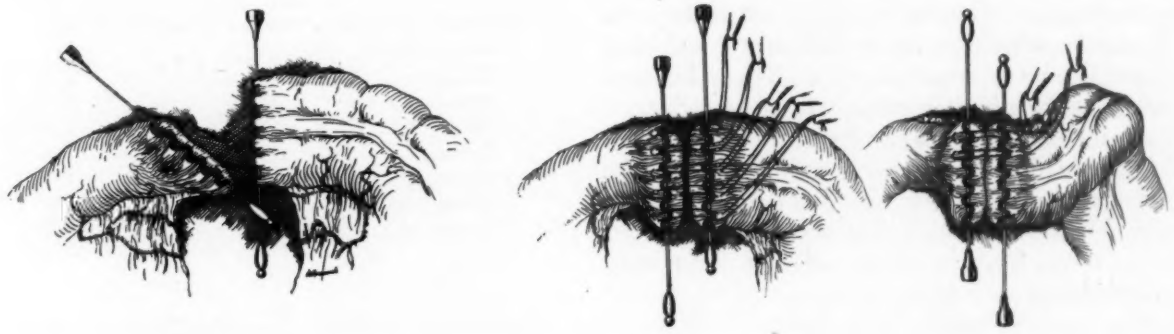


FIG. 2. Application of clamp to terminal ileum with more than usual obliquity to make stoma equal to that of transverse colon.

has been divided obliquely and a one-layer anastomosis performed with Halsted sutures of No. 50 cotton. The Furniss clamp is preferred for its simplicity, the minimal amount of crushed bowel and the fact that bleeding from the bowel ends corroborates the operator's visual impression of viability. Division of the bowel with a cold knife is essential for this observation. Mesenteric defects have been closed with interrupted cotton sutures. No epiploic appendages or omentum have been sutured over anastomoses. Incisions have been closed without drainage or local implantation of sulfonamides by interrupted sutures of No. 40 cotton. When anastomosis within the pelvis has made the Furniss clamp impracticable, open anastomosis has been performed. This was also done when inspection of the interior of the bowel for polyps was necessary An inner layer of interrupted fine catgut sutures and outer layer of No. 50 cotton Halsted sutures were used in the performance of these anastomoses. Continuous sutures on closed or open anastomoses of the colon were discontinued when stomas were noted to be smaller and the resumption of the function delayed when compared to those done by interrupted sutures.

Anesthesia. Inhalation anesthesia by the intratracheal method was used in all save one

patient. This eighty-six year old female was considered unsuitable for any agent other than local procaine because of her cardio respiratory status. A large carcinoma of the splenic flexure with a portion of involved stomach was removed and end-to-end anastomosis performed



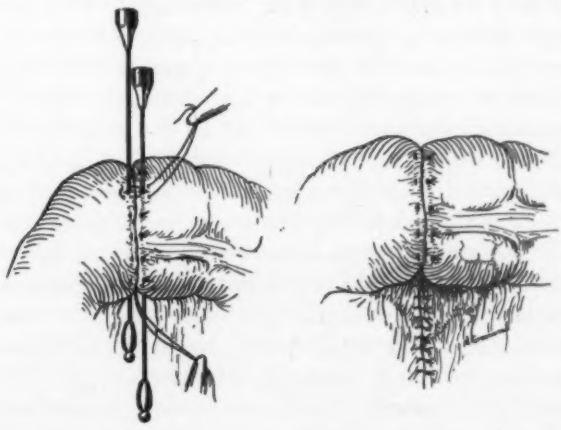
3 4 5

FIG. 3. Transfixed bowel ends ready for approximation.
FIG. 4. Anterior layer of Halsted sutures placed prior to tying.
FIG. 5. The anterior sutures have been tied and the bowel ends rotated 180 degrees for insertion of the posterior layer.

without difficulty under local infiltration of the abdominal wall. General anesthesia is preferred to spinal because of the unpredictable duration of many operations and the necessity for unhurried operating during all phases of the procedure.

Obstruction. Resection and primary anastomosis was possible in seventy-one cases or 79.7 per cent of the patients. Obstruction was the factor making this management unfeasible in all save three of the remaining cases. Relief of obstruction was given priority over all other considerations. Acute large bowel obstruction occurred preoperatively in sixteen or 17.9 per cent of the patients. In thirteen the lesions involved the left colon while the lesion was located in the right colon in three. Obstructions at or proximal to the splenic flexure were managed by cecostomy while those distal to the splenic flexures were relieved by loop colostomy in the transverse colon by Wangensteen's[27] method. Accurate localization of the obstruction was not always possible because of obesity resulting in poor roentgenograms, inability of acutely ill elderly patients to retain barium contrast media and the difficulties of obtaining sufficient cooperation for sigmoidoscopy. Cecostomy was performed in these uncertain situations. Inadvertent placing of a proximal vent in close proximity to the growth is not irremediable so long as this stoma and adjacent abdominal wall are included in the subsequent resection. Cecostomy has not been a uniformly successful procedure for relief of obstructions as far distal as the sigmoid. The bowel in such instances may remain dilated, edematous and contaminated. In one fatality this feature of cecostomy seemed an important factor.

Relief of obstruction by intubation with the Cantor tube was attempted on two cases with obstruction of the ascending colon resulting in a short, closed loop type of obstruction. Despite



6 7

FIG. 6. Halsted sutures placed about pins at each angle before removal of pins.
FIG. 7. Pins have been removed, sutures at the angles tied and mesenteric defect closed.

successful intubation, obstruction was not relieved and cecostomy was necessary in both instances. Lesions of the cecum involving the ileocecal valve may produce a small bowel obstruction which can be relieved by intubation, thereby allowing resection and primary

anastomosis. The exteriorization of a portion of the cecal circumference described by Graham[10] has been the most satisfactory method of performing a satisfactory decompressive cecostomy.

Routine preoperative intubation advocated by Whipple[28,29] and Ravdin[24] was not used. No postoperative obstructions occurred at anastomoses. Complementary cecostomy or ileostomy were not used with any resections. Supplementary cecostomy for obstruction was not necessary in any case.

Cecostomies required closure in all but two instances. Spontaneous closure has been the exception when the bowel was brought up to the skin level. Loop colostomies in the transverse colon have been excised and end-to-end anastomosis performed as advocated by Allen,[2] Coller and Vaughan,[6] and Keene.[14] Although only five such closures have been performed for malignancy, a larger number done in the treatment of inflammatory lesions has not been attended by fatality.

Perforation. Perforation of the growth occurred in six patients. In two of these resection and primary anastomosis were possible as abscess and growth were removed *en bloc*. Of the remainder one required preliminary cecostomy for acute obstruction while a second required preliminary drainage of a large abscess before resection could be carried out. The last two patients presented the problem of large free perforations with spreading peritonitis and were surgical emergencies. In each the growth was resected, the bowel ends left in the wound and the resulting colostomy closed by intraperitoneal anastomosis in the same manner as other colostomies. A wider resection was performed during one patient's closure as the primary procedure was believed to have been deficient in excision of gland-bearing area. These last two cases are cited to illustrate that the exteriorization principle cannot be completely discarded. However, its companion procedure of extraperitoneal anastomosis by spur crushing and extraperitoneal closure would seem to have increasingly rare indications.

Extension of operability to include other organs and structures did not interfere with resection and primary anastomosis. Table I enumerates twenty-one excisions of other structures and organs performed on twelve patients. The small bowel was the organ most frequently resected with the bladder next in order of frequency. These were all one-stage procedures except for two patients who required preliminary relief of obstruction and the one patient in whom an abscess secondary to perforation of the growth had to be drained. There were no fatalities among this group of patients subjected to more radical procedures.

TABLE I
EXCISION OF OTHER ORGANS AND STRUCTURES

Small bowel	8
Bladder	4
Abdominal wall	3
Spleen	2
Cecum	1
Stomach	1
Duodenum	1
Pancreas	1
Total	21

Postoperative Care. Careful preparation and increasingly meticulous operative management have progressively simplified postoperative management. Complete replacement of blood loss in the early postoperative period was the first consideration. Fluids have been started orally on the first postoperative day although the basic requirements have been supplied intravenously. On the second day a soft diet has been started and succinyl sulfathiazole resumed. Passage of flatus occurred in most cases on the second day and from that time forth parenteral alimentation was unnecessary. The mildly cathartic action of succinyl sulfathiazole produced spontaneous bowel movement on the third and fourth day. Antibiotics were not used routinely and were ordered only in the presence of a specific indication. Ambulation was practiced from the first day onward. Its value in promoting speedy return of intestinal motility and diminishing pneumonic complications seemed obvious in this series of patients.

RESULTS

Morbidity is reflected in Table II. The absence of dehiscence and evisceration is attributed to the use of transverse incisions and non-absorbable suture material for wound closure. The postoperative fecal fistula was secondary to the breakdown of an anastomosis in an individual whose depleted nutritional state could not be fully corrected preoperatively. Subsequently in this patient acute cholecystitis and small bowel obstruction due to a loop of jejunum adhering to the gallbladder developed. Release of the jejunum and cholecystostomy were followed by a satisfactory convalescence.

A breakdown of the wound infections shows relationship to the method of anastomosis as previously pointed out by Coller and Vaughan,[6] and Ravdin.[24] There were eight wound infections following twenty-five open anastomoses an incidence of 32 per cent while only five

TABLE II
MORBIDITY

Incisional hernia	4
Fecal fistula	1
Acute cholecystitis with small bowel obstruction	1
Pneumonia	2
Brachial plexus paralysis	1
Phlebitis	2
Wound infections	13
Homologous serum jaundice	1

TABLE III
MORTALITY

Peritonitis secondary to breakdown of anastomosis under tension	1
Postoperative shock	1
B. welchii infection of abdominal wall	1
Postoperative volvulus of ileum with obstruction	1
Cardiac arrest under cyclopropane	1
Pulmonary embolism	1

wound infections occurred after sixty-four closed anastomoses an incidence of 7.8 per cent.

Six deaths occurred in eighty-nine cases, a mortality rate of 6.7 per cent. The causes of these fatalities are shown in Table III. Ravdin[24] has stated that a certain number of fatalities due to peritonitis are almost inevitable. This is unquestionably true but examination of the causes of death in this small series highlights the role of uncontrollable factors and errors of judgment. The death caused by shock represents a failure to evaluate the condition of an eighty-three year old man preoperatively and with the fatality due to anesthesia cannot be attributed to resection and primary anastomosis. On the other hand, the fatality secondary to breakdown of an anastomosis performed under some tension emphasizes the gravity of transgressing the fundamental principles of anastomosis. This was the only fatality occurring after palliative resection. The more radical procedures carried out in resections for cure preclude comparison of mortality rate with those cases in which palliative resection was performed. The fatal Bacillus welchii infection of the abdominal wall illustrates the ineffectiveness of cecostomy as a preliminary procedure in lesions as far distal as the sigmoid. Delayed closure of this wound as advised by Coller and Vaughan[6] might have prevented this complication. Loop colostomy or retrograde flushing of the bowel by Miller-Abbott tube inserted through the cecostomy according to Millet's[20] technic might also have averted this fatal complication. The fatal postoperative volvulus of the ileum was not directly caused by the preceding procedure. The last death due to pulmonary embolism occurred despite early recognition of the thrombotic process, prompt thrombectomy and bilateral superficial femoral vein interruption. Necropsy verified the presence of a very large pulmonary embolus and showed further propagation of thrombus in the common femoral and external iliac veins above the ligature.

SUMMARY

In a series of eighty-nine consecutive resections of the colon for carcinoma resection and primary anastomosis was possible in seventy-one or 79.7 per cent of the cases. Acute large bowel obstruction in sixteen patients or 17.9 per cent of the patients necessitated preliminary decompressive operations and was the most common contraindication to resection and primary anastomosis. Perforation prevented resection and primary anastomosis in three of six cases with this complication. The usefulness of a modified obstructive resection was illustrated in two of these patients with large free perforations and spreading peritonitis. Intraperitoneal anastomosis after obstructive resection seems to be preferable to spur crushing and extraperitoneal anastomosis. Cecostomy was a satisfactory decompressive vent for obstructing lesions proximal to the splenic flexure while loop colostomy in the right half of the transverse colon was more efficient for lesions more distally situated. There was no evidence in this series that complementary vents or routine preoperative intubation with one-stage resection and anastomosis are necessary. Closed anastomosis has demonstrated a lower wound morbidity than open methods. Succinyl sulfathiazole has prepared the bowel well, relieved incomplete obstruction in some instances and has seemed to further early return of bowel motility in the postoperative period. Six fatalities occurred a mortality rate of 6.7 per cent. In only one of these was the method of anastomosis a factor, the remaining being due to errors or factors uncontrollable at the present time.

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METHOD FOR RELIEVING IRREDUCIBLE INTUSSUSCEPTION*

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THIS method for relieving an irreducible intussusception has the distinct advantage of avoiding an operative procedure upon the intestine. It has proved very efficacious in three cases when it appeared that some type of intestinal resection would be necessary. Although it may have been used by others, yet a description of same has not been seen in medical literature.

Much has been written about the treatment of intussusception which usually occurs in infants and children. Barnes[1] has reported the type of intestinal operation which he recommends in irreducible cases. Upon opening the abdomen the surgeon usually finds a length of ileum (intussusceptum) invaginated through the ileocecal valve into the colon (intussuscipiens) for varying distances. In one case to be briefly reported herein the tip of the intussuscepted ileum was located in the sigmoid.

At times the entire intussuscepted ileum is found to be irreducible whereas, in other cases, one is able to reduce part of the intussusception before the remaining portion becomes irreducible. In either case the author has found the following method very effective: In the first maneuver the thumb and forefinger of operating hand are inserted into opposite sides of the ileocecal valve (Fig. 1), and gentle pressure exerted. This pressure is gradually increased in such a manner as to produce a gradual relaxation of the valve with a resulting dilatation. It takes a little time, the pressure being continuous and increased gradually. At first the valve is felt as a very firm, cartilaginous-like ring which is almost closed. If sufficient time is taken for this first maneuver, the ileocecal valve gradually relaxes and opens sufficiently to permit the start of the second maneuver.

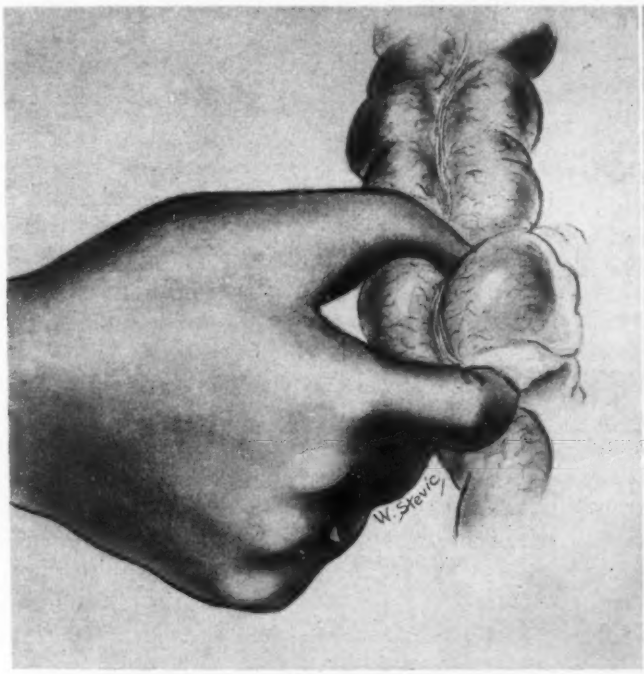

FIG. 1.

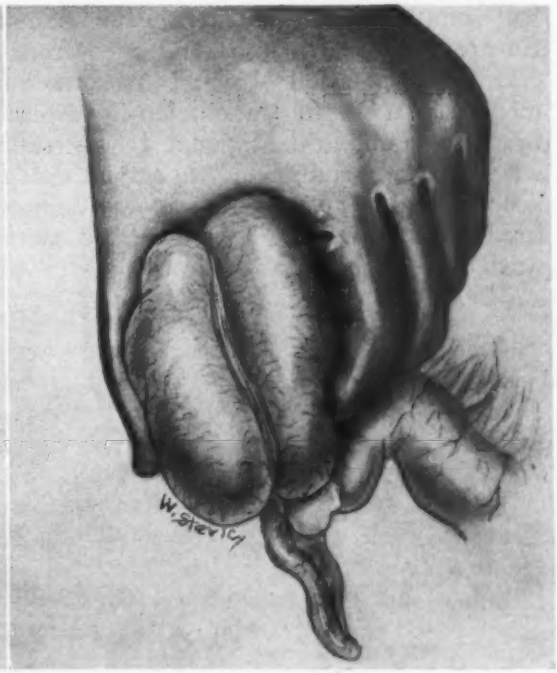

FIG. 2.

In this second stage or maneuver the colon is gently grasped at a point just distal to the end of the intussusceptum, then gradually squeezed.

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(Fig. 2.) This maneuver causes the ileum to return through the ileocecal valve and is continued until the intussusception is completely reduced. Sometimes it is helpful gently to hold the unintussuscepted ileum close to the ileocecal valve in a position that will help guide the return of the intussuscepted portion. This method is simple and very effective.

CASE REPORT

A seven month old girl was admitted to Children's Hospital September 1, 1947, with abdominal pain of a few hours' duration. She was pale, crying, had rapid respirations and had vomited. A mass was felt in the abdomen. Currant jelly-like material returned from an enema. At operation which was performed immediately, the head of the ileum (intussusceptum) was found in the sigmoid. It was reduced without too much difficulty to a point near the ileocecal valve at which it became definitely irreducible. The previously described method was utilized to dilate the ileocecal valve slowly, after which the second maneuver of this method was used to complete the reduction successfully. There was slight fever the following day. Wangensteen suction was removed on the fourth postoperative day. The patient had bowel movements. Recovery was uneventful, and the patient was discharged from the hospital September 12, 1947. The baby has been well since that time.

SUMMARY

A method for relieving irreducible intussusception in infants and children has been described with one illustrative case. This method has proven very satisfactory in three of the author's cases and has the distinct advantage of avoiding resection of a portion of the intestinal tract.

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ISOLATED JEJUNAL INVOLVEMENT IN REGIONAL ENTERITIS*

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SINCE the classical description of terminal ileitis as a disease entity in 1932 many cases have been reported by various authors. Originally it was stated by Crohn[18] and associates that this condition involves only the terminal ileum. Subsequent investigation has shown that this disease may involve any portion of the small bowel and the colon. This investigation led to modification of the terminology to regional ileitis, cicatrizing enterocolitis, jejuno-ileitis, ileocolitis, necrotizing enteritis, regional jejunitis and various other names. The name regional enteritis has come into being as a term to designate this group of disorders characterized by a non-specific, constricting lesion involving any or various portions of the bowel.

Although many cases with involvement of the small bowel above the terminal ileum are recorded, isolated lesions in the jejunum are usually stated to be infrequent. In 1941 Friedlander[27] estimated that the jejunum is involved alone or in combination in 5 per cent of the cases of regional enteritis. Rieben[68] quoted Sproul who estimated that there is jejunal involvement in 4 per cent of cases of regional enteritis. The relative infrequency of jejunal involvement makes it an entity which is not often seen but one which must be considered in the differential diagnosis of symptoms relating to the upper part of the abdomen and especially those referring to the left upper quadrant.

We were fortunate in observing a case of regional enteritis in which the lesion proved at operation to be confined to the jejunum. This patient had previously been diagnosed as having a duodenal ulcer and had showed marked improvement on medical management. Surgical intervention became necessary when symptoms of intestinal obstruction appeared later. It is our purpose here to present a survey of the literature pertaining to isolated regional jejunitis and to add one case to the literature.

In 1939 Shapiro[70] reviewed the literature concerning regional enteritis to that date, and of a total of 462 cases surveyed, recorded sixteen cases with involvement of the jejunum alone. Ravdin and Johnson[63] also reviewed the literature in 1939 and reported 261 cases involving the terminal ileum alone, 100 cases involving the terminal ileum and cecum and two cases involving other portions of the small bowel. Ragonotti[62] in 1939 reported one case with involvement of the duodenum and proximal jejunum proved at operation. In the same year Mayer-May and Tung[54] reported eleven cases of regional enteritis, of which in one patient observed at operation there was isolated jejunal involvement. Eliason and Johnson[23] reported one case which at necropsy showed involvement of the jejunum and ileum with perforation in both areas. Marshall[51,52] in 1940 reviewed a series of forty-nine cases seen at the Lahey Clinic, of which twenty-nine patients had surgery. Of the cases in which there was operation, Marshall recorded one case with isolated involvement of the jejunum. Brown and Donald[11,12] reviewed 178 cases of regional enteritis seen at the Mayo Clinic between 1922 and 1940, and reported five cases with involvement of the jejunum only. Browne and McHardy[10] reviewed 1,161,663 consecutive admissions to two New Orleans hospitals with 7,970 autopsies to determine the incidence of jejunal pathologic conditions. They reported one case of regional jejunitis in their series. In 1941 Sneiderson and Ryan[72] reported one case, proved at operation to involve the ileum, which later spread to involve the jejunum. Eckel and Ogilvia[21] reported twenty-one cases of regional enteritis, of which six patients were treated surgically. Of these six patients, two had involvement of the jejunum and ileum; two other patients were observed to have such extensive involvement of the jejunum and ileum that they were considered inoperable. Reich and Danzis[65] noted one case which began

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in the ileum and spread to the jejunum. Manohar[50] reported fifty-one cases of non-specific ulcers of the small bowel, some of which were confined to the jejunum. Kini[43] reported three cases from India in one of which there was hypertrophy of the jejunum with lesions located in the ileum. Smithy[71] reported five cases of regional enteritis, with one case proved at operation which involved the jejunum from the ligament of Treitz to the jejuno-ileal junction. Of thirty-one cases observed by Ashley, Myers and Reynolds,[3] one case showed involvement of the ileum and jejunum. In a series of thirty-two cases Fallis[24] reported one case (3.1 per cent) of regional jejunitis, one case involving the lower jejunum and upper ileum and one case with multiple lesions in the jejunum and ileum. Guadarrama[29] reported eleven cases with aspecific granulomatous lesions in the small bowel which were proved surgically. Of these, there was one with involvement of the duodenum and jejunum, three with lesions confined to the jejunum and five with involvement of the jejunum and ileum. In 1943 W. R. Johnson[40] reported one case of isolated jejunitis which was diagnosed by x-ray and proved at operation. In the discussion of this article Crohn reported a similar case in a Chinese male reported to him in a personal communication. This same case was reported more thoroughly by Brewster[9] in 1944. Adlersberg and Sobotka[1] in 1943 and Killian and Inglefinger[42] in 1944 discussed the dietary problems presented in jejuno-ileitis, each article being illustrated with a case report. Coors[17] reported one case of localized jejunitis observed at operation. Ibarguen[38] noted one case of regional enteritis which proved at operation to be localized to the jejunum. The etiology of this case was ascribed to a concomitant ascaris infection. Koenig[44] reported the surgical and pathologic findings in one case of localized jejunitis in 1945. Pugh[61] observed one patient with extensive regional enteritis involving the jejunum and ileum to within 3 feet of the ileocecal valve. Haberer[30] reported on one patient who was still asymptomatic four years after surgical removal of an isolated jejunal lesion. In the discussion of Cave's[16] paper Dr. Marie Ortmayer reported one case of localized jejunal enteritis which was seen on x-ray examination and proved at autopsy. In the same year Bockus[8] reported the postmortem findings on one patient in whom the lesions were confined to 3 feet of the jejunum. This case had previously been reported by Bockus, Tumen and Kornbloom[6] in 1940 as a case of tuberculous enterocolitis with radiologic demonstration of involvement of the jejunum and ileum. The pathologic changes seen in this case were those of non-specific regional enteritis. In 1945 Spellberg and Gray[73] observed one case of localized regional jejunitis in a soldier which appeared following trauma to his abdomen. Rees[64] noted one patient with regional jejunitis having four distinct constricting lesions all localized within a 4-foot section of the jejunum. In 1946 Homb[35] recorded eight cases of acute jejunitis in which five patients were operated upon and the remainder treated conservatively. Of these patients, x-ray studies were performed on seven and diagnostic changes were observed in five. Lyon and Garlock[48] recorded one case with involvement of a section of the jejunum 10 inches long. In 1946 Bhende[5] saw one patient with chronic jejunitis and observed, "In this country Manohar (1941), from the post mortem material of our department has described a series of 51 cases of non-specific ulcer of the alimentary tract; in four of these cases the jejunum was involved in a chronic process. It is possible that some of these cases may have been early cases of regional enteritis." In 1946 Camacho[14,15] and Gendel and Beaver[28] each reported one case of regional jejunitis. S. Brown[13] in a presentation of twelve cases of regional enteritis diagnosed radiologically reported two cases which involved the ileum and jejunum and one case involving the duodenum. Oppenheimer[59] reported one case which proved at operation to be localized jejunal enteritis. This patient was operated upon again six months later and a recurrence of the lesion was noted. Koop and Perlingiero[45] observed one case in which there was involvement of the entire small bowel. Wigand[76] reported fifty-five cases of necrotic jejunitis of which thirty-three cases came to operation or post mortem and twenty-two were diagnosed by clinical findings. In reporting this series the author did not indicate how many of the patients had isolated jejunal lesions. Haffke[31] reported one case of localized jejunitis in 1947. Menzel and Boving[57] in 1947 observed ten cases of necrotic jejunitis of which they recorded the operative or necropsy findings in six. Of these six cases, two involved the jejunum only, two involved the duodenum and jejunum and two involved

the jejunum and ileum. Hodges, Rundles and Hanelin[34] reported a series of twelve cases of regional enteritis of which there were two cases of regional jejunitis diagnosed by x-ray examination and proved surgically. They also reported another case of regional jejunitis which was diagnosed by x-ray and explored surgically but not resected. After seventeen months of medical management this patient showed no radiologic abnormality. Janus[39] reported one case of regional enteritis involving the terminal duodenum and two cases with localized jejunal involvement. Franz[26] recorded one case of necrotic jejunitis. Husbeye[36] of Stockholm reported fourteen cases of acute phlegmonous jejunitis which were diagnosed radiologically, with six which were proved at operation. Two of these patients died postoperatively and postmortem examination showed the typical changes found in regional enteritis. Seven patients were treated medically with penicillin and sulfadiazine and improved. Again in 1948 Husbeye[37] reported the postmortem findings in one case of non-specific jejunitis in which the patient had been operated upon in 1928 and again in 1945 because of regional enteritis. The findings at necropsy consisted of a constricting lesion confined to the upper jejunum. Kulpe[47] in 1948 reviewed eight cases of regional jejunitis which had been reported previously in Germany and suggested enteric intoxication as the cause of regional jejunitis.

During the past ten years several authors[19,20,22,68] have reported large series of jejuno-ileitis but cases with isolated jejunal lesions were specified in these series.

In a review of the literature for the past ten years we have found a total of eighty-four accepted cases of regional enteritis, with isolated involvement of the jejunum. Of these, sixty-five were proved at operation or necropsy. In view of the fact that sixty-five cases of this "infrequent disease" have been proved and recorded, it would appear that isolated regional jejunitis is more common than is usually suspected. It is therefore a disease which must be definitely considered in the differential diagnosis of a patient presenting symptoms referrable to the upper portion of the abdomen which are suggestive of but on radiologic examination fail to show an ulcer. However, due to the more recent radiologic refinements, many cases of this disease have been and can be diagnosed prior to exploration.

The etiology of regional enteritis has been discussed at length by many different authors[2,4,7,41,58,67] in the past. Several cases have been noted to which a definite cause could be ascribed; however, to date there has been no general agreement as to the etiology of this disease. In 1947 an interesting observation was made by Saltzslin[69] who reported a series of twelve Mann-Williamson dogs which were subjected to transthoracic vagotomy. He observed that in seven of these dogs jejunitis of varying severity developed.

An excellent discussion of the gross and microscopic changes found in regional enteritis has been given by Owens.[60] Many others[4,7,32,41,55,75] have written on this phase of the problem.

SYMPTOMS AND FINDINGS

As in terminal ileitis the symptoms in localized jejunitis vary with the stage of the disease process. Although terminal ileitis is frequently described by many authors[2,7,67] as occurring in four stages, the fourth or fistula-forming stage is rarely observed in primary jejunitis.

In the acute stage the picture presented is that of an acute upper abdominal lesion which may be mistaken for a perforating ulcer. Usually pain, tenderness and postprandial gaseous distention are located in the upper portion of the abdomen more often on the left side. Nausea and vomiting after meals are often present and leukocytosis may be a prominent feature. Fever may be present to a variable degree. In this stage there is usually no palpable mass. Diarrhea may or may not be a symptom.

The chronic or ulcerative stage is characterized by cramping, colicky abdominal pains, especially after meals. The fact that these are relieved with a bland diet and antispasmodics may lead to confusion as to diagnosis. During this stage there are usually asthenia, weight loss, anorexia and a variable degree of general malaise. A slight anemia may be present and a low grade temperature may be recorded. Diarrhea may be present and blood or mucus may appear in the stools. It is of interest to note that Mendelsohn[56] reported one case of chronic regional enteritis involving the upper ileum which was diagnosed and successfully treated as a gastric ulcer for five years before the true nature of the lesion was discovered. The symptoms in this stage can easily be con-

fused with those found in a healing gastric ulcer.

In the obstructive stage the symptoms and findings, due to thickening of the bowel wall and occlusion of the lumen, will be those of an acute upper intestinal obstruction. The severity of the symptoms varies with the degree of obstruction. This may be the first stage to appear clinically, and the diagnosis will be confusing if the history of the preceding ulcerative stage is not available. Nausea and vomiting shortly after meals are frequent as are severe abdominal cramps. In this stage tenderness and a palpable mass are often noted in the left side of the abdomen, usually in the left upper quadrant. Fever is a constant finding and secondary anemia is common. Diarrhea with or without blood and mucous in the stools may or may not be present.

The differential diagnosis of isolated regional jejunitis is complicated by the fact that this disease process may simulate either an upper or lower abdominal pathologic disorder depending on the location of the lesion. However, the symptoms usually point to the upper abdomen. Stomach and duodenal ulcers may be simulated especially in the earlier stages if the patient gives a history of epigastric fullness, "gas on the stomach" after meals, upper abdominal cramps, nausea and vomiting. This is especially true if there has been clinical response to dietary management and antispasmodics. In the later stages with a palpable mass neoplastic involvement of the small and large intestines may be simulated. Amebic granuloma must be ruled out. Definitive diagnosis can usually but not always be made by x-ray examination.

The age group[58,67] affected in regional jejunitis closely parallels that found in terminal ileitis, with the average age being about twenty-eight years. Sex and race do not appear to be important factors.

Sussmann and Wachtel[74] noted that clubbing of the fingernails was an incidental and interesting finding in 40 per cent of their series of twenty-three cases of regional enteritis. We also noted moderately severe clubbing of the fingernails in the case presented herein.

TREATMENT

The treatment of regional jejunitis may be medical or surgical, largely depending on the stage of the disease. Medical management, utilizing a bland diet which is rich in protein and vitamins but low in fat, antispasmodics, and chemotherapy using the sulfonamides, penicillin and streptomycin, may cause at least temporary response in the earlier stages. In the obstructive stage surgical intervention is usually necessary. Mac Kinnon,[49] Homb,[35] Hodges, Randles and Hanlin,[34] and Husbeye[36] have reported cases of regional enteritis and regional jejunitis which showed improvement on medical treatment. However, conservative management in the great majority of these cases is disappointing, especially in the later stages of the disease, and surgical treatment is usually indicated. It is not our purpose to discuss the relative merits of the various surgical procedures at this time. However, as with terminal ileitis, the surgical procedure which appears to produce the most favorable results includes resection of the involved portion of the jejunum and anastomosis.

CASE REPORT

The patient, a twenty-eight year old white World War II veteran, was first seen July 19, 1948, complaining of cramp-like abdominal pains which had been present for the preceding three days. The pains began suddenly, continued intermittently and seemed to be progressively more severe. The pains were "all over" the abdomen with no radiation or localization. Along with the abdominal pains he noted a distended feeling "like gas on my stomach." The cramps and the gaseous sensation appeared more often following meals and were relieved temporarily by ingestion of milk or antacids. There had been no nausea, vomiting or diarrhea although he gave the history of "soft, poorly formed stools since 1945." Prior to the onset of the present illness his general health had been good. He had noted no significant weight change during the preceding six months.

His appendix had been removed in 1942. He described one episode of moderately severe diarrhea while in Italy with the U. S. Army in 1945. The etiology was not known to him but it responded well to conservative treatment.

He had noted slight intolerance to fried and fatty foods for about one year prior to onset of the present illness. Since 1945 bowel habit had consisted of one to two semi-solid stools daily. He denied any bloody, tarry or acholic stools. His family history was non-contributory. He was married and had one child. At the time of

admission he was employed as physical education instructor in the local high school.

Physical examination revealed a well developed and well nourished white male who appeared to be in only slight distress, with a temperature of 99°F., pulse 96, respirations 16 and blood pressure 120/70. He walked erect but was occasionally forced to pause because of abdominal pain. He appeared somewhat apprehensive and seemed to be rather high strung and of an "ulcer temperament." The skin was warm and dry with no notable dermatoses. Eyes, ears, nose and throat were normal except for slight nasal and pharyngeal injection. Heart and lungs were normal. Examination of the abdomen revealed slight muscle-guarding in the entire upper portion, slightly more pronounced in the left upper quadrant. No rebound or flank tenderness could be elicited. The soft organs were not palpable. In the right lower quadrant there was an old, well healed McBurney scar. Extremities showed moderately severe clubbing of the fingernails. Rectal and neurologic examinations were normal.

Laboratory studies on admission showed a white blood count of 12,950, with a normal differential count. Thymol turbidity, van den Bergh and serum amylase tests were normal. Chest and scout films of the abdomen were normal.

On the following day the white blood count was 6,600 with a normal differential count, red blood count 3,350,000 and hemoglobin 73 gm. per cent. The blood sedimentation rate was 23 mm. per hour; the blood Kahn test was negative and urinalysis normal. Barium enema showed slight medial displacement of the descending colon in the splenic area as though by an extrinsic mass and slight tenderness on palpation over the splenic area during fluoroscopic examination. Upper gastrointestinal series showed marked irritability of the duodenal bulb and slight tenderness on palpation over the bulb but no constant filling defect. The findings were suggestive of a healing duodenal ulcer.

Because of the indeterminate radiologic findings as well as the clinical picture compatible with a duodenal ulcer on the first day the patient was started on the Sippy diet, with antispasmodics and amphojel. Within twenty-four hours after institution of the restricted dietary regimen, he became entirely asymptomatic. He remained asympatomatic and afebrile until he was discharged from the hospital under treatment on July 23, 1948.

Another upper gastrointestinal done on him as an out patient August 4, 1948, was reported as showing no abnormality except for slight deformity of the duodenal bulb.

On the restricted diet and antispasmodics he remained asymptomatic for about two and a half weeks at which time he was advanced to a bland diet. A short time later he noted return of the cramp-like abdominal pains and he frequently had a gaseous, distended feeling in the mid-portion of his abdomen. The pains occurred usually after meals and made him feel that if he could move his bowels he would feel relieved. However, bowel movement did not effect relief. There were no bloody, tarry or acholic stools. Repeated stool examinations showed no ova or parasites and no blood or mucus. In contradistinction to the first episode, at this time he experienced quite severe nausea on several occasions but did not vomit. Over a two-week period he lost about 8 pounds in weight. He was again admitted to the hospital on August 28, 1948, because all symptoms suddenly became much more severe and a perforating ulcer was suspected.

Physical examination at this time showed normal temperature, pulse, respiration and blood pressure. Heart and lungs were normal. He appeared to be in severe distress because of abdominal pain, and very apprehensive. Occasionally he doubled up as though seized by abdominal cramps. Even though he reported moderately severe tenderness on deep palpation, most marked across the abdomen at the level of the umbilicus, the abdomen was soft and flat. There was no rebound or flank tenderness. No masses or soft organs were palpable. Laboratory studies showed normal thymol turbidity, serum amylase, van den Bergh, A/G ratio and cephalin flocculation tests. Agglutinations for typhoid, paratyphoid and brucellosis were normal. Complement fixation for amebiasis was positive. Intradermal tuberculin test was negative. Blood sedimentation rate was 25 mm. per hour on admission. Blood count revealed red blood cells 5,050,000, hemoglobin 100 gm. per cent and white blood cells 12,400 with a slight shift to the left in differential count.

Following admission the patient was put to bed and given atropine and demerol hypodermically. The symptoms subsided rapidly and he

was restarted on the Sippy diet with tincture of belladonna every four hours. But this time conservative measures produced only slight, temporary relief from the abdominal discomfort. He continued to lose weight and noted marked anorexia and a feeling of general malaise. Over the course of the next ten days the pains became more severe and gradually localized to the left upper quadrant and radiated to the xyphoid. On August 31st for the first time a mass, thought to be the spleen, was palpated below the left costal margin. Because of the positive complement fixation for amebiasis and the possibility of an amebic granuloma, the patient was started on emetine, 1 gr. daily emperically, but no improvement was noted after five days. The abdominal mass became gradually larger and the patient began running a daily temperature varying from 99.8 to 100.4°F.

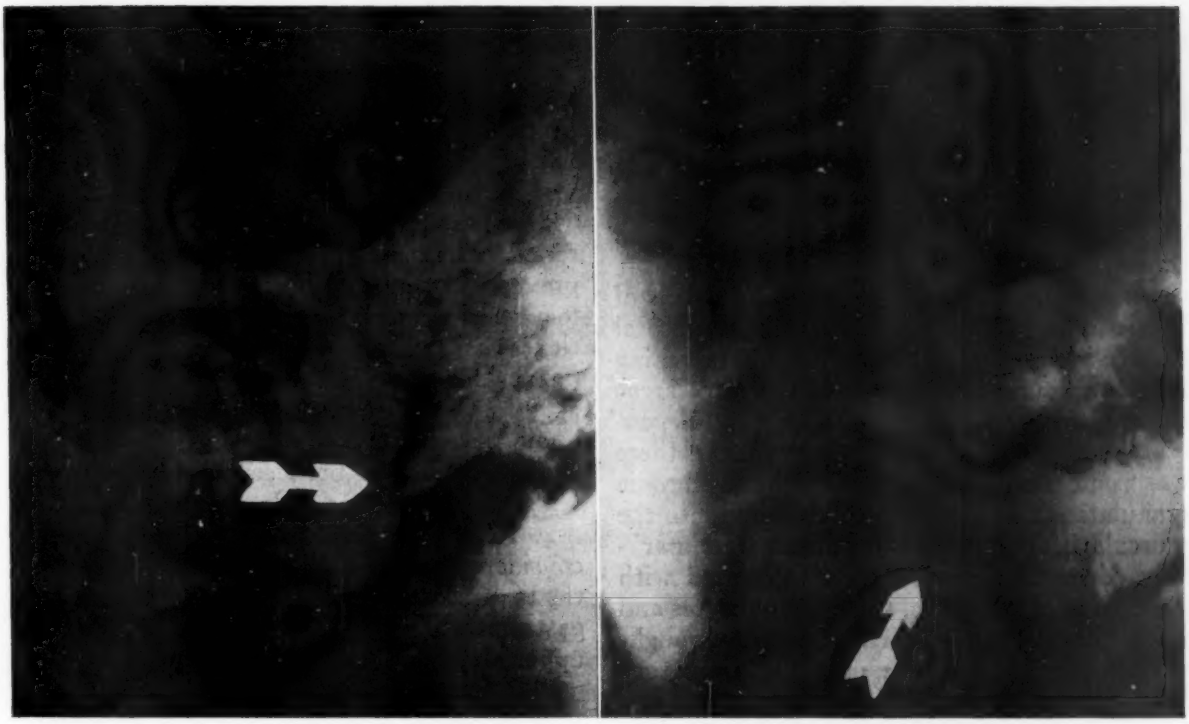
Further laboratory studies including blood counts, stool examinations for ova, parasites, blood and mucus, intravenous pyelogram and repeat chest films were normal except for the blood sedimentation rate which remained consistently elevated. On September 16th this man appeared much worse clinically, and evidence of early intestinal obstruction was noted. A white blood count was 20,800, with a marked shift to the left in differential count. The mass in the left upper quadrant was easily palpable and markedly tender. Inasmuch as his condition seemed to be progressing despite medical management, surgical exploration was considered to be indicated. The preoperative clinical impression was either a slowly perforating duodenal ulcer with abscess formation, an abscess resulting from a perforated single diverticulum or an amebic granuloma which had failed to respond to emetine. The possibility of a perinephritic abscess was ruled out by intravenous pyelogram.

On September 17th an exploratory laparotomy was performed by one of us (J. R. W.) through a high left transverse incision. When the peritoneum was opened, clear, straw-colored, free fluid was noted in the abdominal cavity. In the left upper quadrant a firm, adherent mass approximately the size of a grapefruit was palpated. Inspection revealed this mass to be composed of a loop of the jejunum which was firmly adherent to the posterior abdominal wall and covered with dense adhesions. The bowel wall in this area was markedly thickened, indurated and a dusky red in color. The mesentery in this area was brawny and indurated, and many enlarged, firm, mesenteric nodes were palpable. After the adhesions were dissected, an abscess cavity measuring about 4 by 3 by 2 cm. and containing about 3 ounces of thick, yellowish green pus was found in the mesentery of the jejunum at its junction with the posterior abdominal wall just superior and medial to the left kidney. The area of regional enteritis was found to be localized to the proximal jejunum beginning about 35 cm. distal to the ligament of Treitz and involving 60 cm. of the small bowel. No perforation was found in the bowel wall and the abscess was presumed to be due to necrosed mesenteric lymph nodes. Inspection of the remainder of the small bowel and large bowel showed these structures to be normal. The affected 60 cm. of jejunum plus about 10 cm. of normal bowel on either end with the adjacent mesentery were removed and an end-to-end anastomosis was performed. The peritoneal cavity was drained through a stab wound in the left lateral wall and the operative wound was closed.

Postoperatively this patient was decompressed by constant suction through a Levine tube for the first four days. He was given blood, plasma and parenteral feedings. On the fourth day he was started on clear liquids and his diet was gradually advanced. He was given streptomycin intramuscularly in doses of 250,000 units every six hours for four days. His temperature varied from 100° to 101°F. for the first six postoperative days and then varied from 99° to 100°F. for the succeeding six days. After that time his temperature was normal until discharge on the twentieth postoperative day. The operative wound healed by primary intention and the stab wound healed by secondary intention after draining very slightly for about six days. On the fifth postoperative day slight diarrhea developed, with four to six fluid stools per day. This lasted for four days but subsided spontaneously; subsequent bowel movements were well formed once daily. The patient was asymptomatic when discharged on October 7, 1948, still on a bland diet.

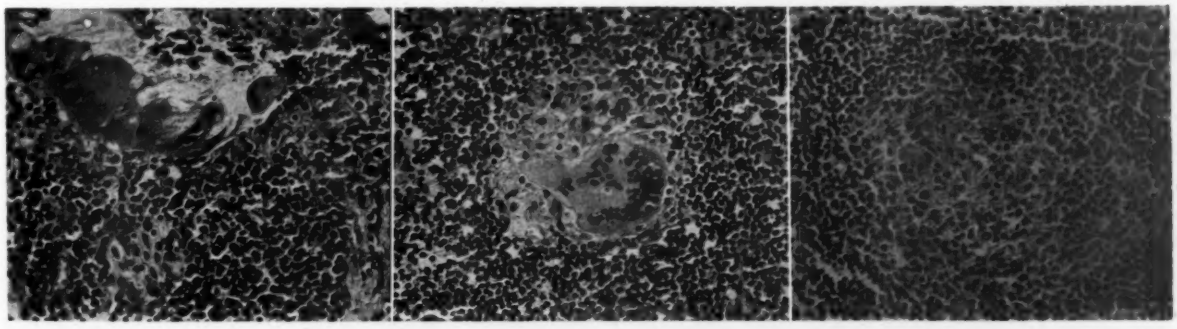
When seen three weeks later he complained of mild, mid-abdominal cramps. A more restricted diet was instituted and tincture of belladonna was prescribed before meals, following which symptoms subsided.

Re-examination of the x-ray films of the stomach and small bowel postoperatively showed



1 2

FIG. 1. Anteroposterior view of the abdomen fifteen minutes after ingestion of barium showing a constricting lesion in the jejunum.
FIG. 2. Lateral view of the abdomen fifteen minutes after ingestion of barium showing the constricting lesion in the jejunum.



3 4 5

FIG. 3. Photomicrograph showing the mucosa with hyperplasia of the epithelium and a very heavy infiltrate of plasma cells and lymphocytes deep to the epithelium.
FIG. 4. Photomicrograph of the submucosa showing a Langhans type giant cell surrounded by epithelioid cells.
FIG. 5. Section from a mesenteric node with an attempt at tubercle formation in the germinal centers.

the constricting lesion in the upper jejunum which had been overlooked preoperatively. (Figs. 1 and 2.) Followup studies including barium enema and upper gastrointestinal series were normal in December, 1948, and again in April, 1949.

Pathologic examination of the resected specimen revealed the following: Grossly, the specimen consisted of a formalin-fixed 70 cm. segment of jejunum and a 15 by 8 cm. triangular segment of omentum. The jejunum was partially opened. In the central portion there was marked induration of the wall and the omentum with constriction of the lumen so that it admitted only the tip of the dissecting scissors. This constriction extended for approximately 9 cm. Here the mucosa was eroded with only small islands of mucosa measuring up to 0.8 cm.

in diameter remaining. The muscularis was thickened and fibrotic measuring 0.8 cm. in thickness. The mesentery and omentum were thickened, fibrotic and with multiple areas of hemorrhage scattered throughout. Distal to the obstruction the mucosa was intact, within the lumen was some clotted blood. Proximal to the constriction the mucosa was bile-stained and otherwise unremarkable.

Microscopically, sections showed portions of the jejunum. (Figs. 3, 4 and 5.) The mucosal surface in areas was ulcerated with intervening islands of mucosa. Covering the ulcerated areas were thin layers of necrotic débris and degenerated polymorphonuclears. Beneath this there was some fibrinoid degeneration and chronic granulation tissue which had extended into the muscularis. The islands of mucosa were markedly edematous and diffusely infiltrated with myriads of plasma cells, small lymphocytes and a few polymorphonuclears. Scattered throughout the muscularis were many inflammatory cells consisting of polymorphonuclears, lymphocytes, plasma cells and, in areas, many esoinophiles. The serosa was markedly edematous. Here as well as within the mesenteric fat there was a diffuse infiltrate of acute and chronic inflammatory cells. The lymphocytic infiltrate was markedly perivascular. In areas there was much fibroblastic proliferation and in some areas of the serosa there were a few tubercle formations along with an occasional giant cell. Within some of the blood vascular spaces were small thrombi and there were some areas of necrosis within the mesenteric fat. The lymph node showed the germinal centers to be hyperplastic. The sinusoids were markedly dilated. There were collections of epithelioid cells with poor tubercle formation. Scattered throughout were myriads of small lymphocytes and many plasma cells. There was no evidence of specific infection or malignancy. The pathologic diagnosis was regional enteritis. No growth was obtained on cultures of the pus from the abscess cavity. Culture of the peritoneal fluid showed occasional staphylococcus, probably a contaminent.

This man was followed-up as an outpatient for eight months after operation and remained asymptomatic. He had no further episodes of abdominal pain and his bowel habits were normal. When last seen he was carrying on his usual activities and gaining weight. He apparently has a complete recovery.

CONCLUSIONS

1. A survey of the literature as pertains to jejunal involvement in regional enteritis is presented. Eighty-four cases with isolated jejunal lesions have been reported, of which sixty-five were proved at operation or necropsy.

2. We are reporting one case of regional enteritis with isolated involvement of the jejunum, proved at operation, in which the patient was followed-up for eight months. To date this patient has apparently made a complete and uneventful recovery.

3. In the case presented the symptoms and findings were confused with those of a duodenal ulcer, especially so because the patient showed temporary response to ulcer management.*

4. Regional enteritis of the jejunum must be considered in the differential diagnosis of patients presenting signs and symptoms of a gastrointestinal pathologic disorder in the upper abdomen.†

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* Physical examination, gastrointestinal series and laboratory studies performed in June, 1950, (twenty-one months postoperatively) demonstrated no appreciable change in this man's general condition.

† Since this article was written three additional cases of chronic non-specific jejunitis proved at operation have been reported by R. B. Green in the *United States Naval Medical Bulletin*, May–June, 1949.

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Scarff and Kalinowsky find that prefrontal lobotomy can be safely done under direct vision and that the results are often very good and should be tried wherever indicated for certain psychiatric cases. Among other types of cases, they especially believe it is indicated in schizophrenics who fail to respond to an adequate course of shock treatments, but recommend that the operation be done in such cases as soon as it becomes apparent that shock therapy is ineffectual. The authors state that, as proven by psychometric tests, "permanent" intellectual impairment due to the prefrontal lobotomy is absent, but "spontaneity, future planning, and emotional response" do show deteriorating changes after such surgery. (*Richard A. Leonardo, M.D.*)

GELFOAM® AND THROMBIN IN TREATMENT OF MASSIVE GASTRODUODENAL HEMORRHAGE

A PRELIMINARY REPORT

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IT is difficult to evaluate the value of any hemostatic agent in the treatment of massive gastroduodenal hemorrhage because of the marked reduction in mortality rate being reported as a result of a rigid medical routine. Heuer[1] in a study of 337 patients admitted with massive gastric hemorrhage reported 86 per cent of all patients recovered without surgical intervention; 14 per cent of all patients admitted were subjected to surgical intervention. Since this report appeared as late as 1946, the trend of medical thought appears to be toward a conservative form of treatment for at least the first twenty-four to forty-eight hours.

There is general agreement among all surgeons that if a patient does not respond to rigid medical treatment within the first twenty-four to forty-eight hours, surgical intervention is indicated. It is well known that the mortality rate rises sharply in the surgically treated group after forty-eight hours. Conservative management implies treatment such as adequate replacement of blood, bed rest, morphine and various diets such as Meulengracht's diet.

With this routine Sandusky and Mayo[2] have reported a mortality rate of 5 per cent in a group of 101 patients of a series of 119 admissions who were treated non-operatively. In the remaining eighteen cases of this series in which the patients were surgically treated the mortality rate ranged from 14.2 per cent to 54 per cent depending upon the type of surgery. In 1949 the trend toward conservatism appeared to be more clearly defined by the paper of Fraser and West[3] who reported on 177 patients with massive duodenal hemorrhage of whom 165 were treated conservatively with a mortality rate of 4.2 per cent, and twelve patients treated surgically after forty-eight hours with a mortality rate of 33.3 per cent.

Costello[4] at about the same time reported a study of three hundred consecutive cases of massive gastroduodenal hemorrhage of which a 25 per cent mortality rate was reported for all methods of treatment. In the last two years he set up a non-operative routine in which adequate replacement of blood, bed rest, feedings, sedation and antacids were the principal features. During this interval of time seventy-three patients were treated with this method, with a mortality rate of 4 per cent. Costello was of the opinion that the single most important factor responsible for the reduction of mortality rate from 25 per cent to 4 per cent in his group of patients was the adequate blood replacement.

The work of Daly and co-workers[5] at Wayne University in which buffered thrombin was given to all patients with massive gastric hemorrhage in addition to other conservative measures has produced quite promising results. However, a mortality rate of 4 per cent as reported by Costello for his non-operative group in which merely supportive measures were employed without any direct attack being made upon the bleeding site in the stomach or duodenum makes it difficult to ascribe any beneficial effects to any hemostatic material used unless a mortality rate appreciably lower than 5 per cent can be reported in a large enough group of patients.

The remarkable hemostatic effect reported by the use of gelfoam® and thrombin in neurosurgery and urologic surgery resulted in our experimental employment of these two hemostatic agents in experimentally produced venous and arterial lesions of the dog's stomach.[6] The dramatic hemostatic results obtained seemed to justify a clinical study in which gelfoam®* and thrombin were used

*Supplied by the Upjohn Company, Kalamazoo, Mich.

clinically in the treatment of massive gastroduodenal hemorrhage. By so doing we are fully aware that the artificially produced bleeding lesion in the dog's stomach created by excising segments of gastric mucosa is in no sense comparable with the chronic indurated ulcers so commonly found in humans. The firm, flat, tenacious clot which formed in all our experimental animals led us to believe that gelfoam® and thrombin would furnish a useful addition to our armamentarium in the first twenty-four to forty-eight hours of conservative management of a patient with massive gastroduodenal hemorrhage.

To date we have treated twenty-eight patients. These were all admitted to the hospital with a diagnosis of massive gastroduodenal hemorrhage. No patient was put in this group unless the blood count was under 3,000,000 red blood cells, and in most of the patients red blood counts under 2,500,000 were found. We had intended to wait until 100 patients had been treated by the use of gelfoam® and thrombin before reporting the results obtained. By so doing a sufficient number of patients would be available from whom definite conclusions could be drawn. The remarkable results obtained in this group of twenty-eight consecutive patients, however, has impelled this preliminary report in order that the method may be used more widely. Only by so doing can a sufficient number of patients be treated over a relatively short period of time. This would permit proper evaluation of the place of hemostatic preparations in the treatment of massive gastroduodenal hemorrhage.

METHOD USED

Any patient admitted to the hospital with a diagnosis of massive gastroduodenal hemorrhage is treated as having an acute surgical emergency without surgical intervention. We believe that all such patients should be on the surgical service and under the close attention of the surgical staff during the first twenty-four to forty-eight hours. Only by so doing can a patient with an exsanguinating type of hemorrhage be diagnosed early and operated upon during the golden period offered within the first forty-eight hours. Our criterion for such a diagnosis is any patient who does not develop circulatory balance within the first twenty-four hours despite adequate blood replacement, which may require 3,000 cc. of whole blood, or any patient who begins to bleed again after once having ceased to bleed.

Those patients in whom a diagnosis of exsanguinating type of hemorrhage has been made (there was one in our series) are given 1,000 cc. of whole blood and operated upon within twenty-four hours. We do not believe any operation short of a gastric resection with removal of the ulcer to be adequate in the surgical treatment of such cases. To do an exclusion operation leaving the ulcer is to invite disaster.

All patients admitted are immediately seen by the surgical resident and the following routine instituted: (1) History is taken and physical examination made to ascertain the etiologic basis for the gastric hemorrhage. (2) Complete blood count is taken. Blood studies are done to rule out blood dyscrasias. (3) Treatment is instituted for shock if present. (4) Blood pressure and pulse readings are done every two hours for the first forty-eight hours. The attending surgeon is notified immediately if the blood pressure drops below 90 mm. of mercury or if the pulse shows a progressive elevation. (5) There is replacement of blood depending upon the condition of the patient and the red blood count. Patients in shock are given 1,000 cc. of whole blood immediately. Patients with red blood counts below 2,000,000 are given 1,000 cc. of blood at once; patients with red blood counts over 2,500,000 are given 500 cc. of whole blood. Blood is then given as often as needed within the first twenty-four to forty-eight hours in an effort to maintain circulatory balance. A progressive rise in blood pressure and a drop in pulse rate is an index of improvement. A continuing drop in blood pressure and elevation of pulse rate despite adequate blood replacement within the first twenty-four hours is an indication for surgical intervention. As much as 10,000 cc. of blood may be given during this period of time. (6) In addition to adequate blood replacement and the conservative routine of Meulengracht's diet, antacid therapy, sedation and bed rest, the only new and additional therapy is our use of gelfoam® and thrombin. (7) The gelfoam® is prepared as a fine dry, very light powder. Well over 75 per cent of the patients admitted with massive gastroduodenal bleeding present an obvious diagnosis of gastroduodenal ulcer. In these cases two

tablespoonsful of gelfoam® are mixed with 2 ounces of milk and cream and given to the patient orally every two hours. Immediately following this the patients are given 250 units of thrombin solution. The thrombin solution is prepared by dissolving 1,000 units of thrombin in 200 cc. of water; 50 cc. of this solution containing 250 units is then given after the gelfoam.® (8) Amphojel is given following the thrombin solution in a dose of one tablespoonful every three hours. The purpose of the amphojel aside from its mild astringent action is to neutralize the acidity and prevent the action of the pepsin in the digestion of the blood clot to be formed over the ulcerative area. (9) If a diagnosis of bleeding from esophageal varices is made, gelfoam® powder is given in its dry state and is then followed by thrombin solution. The dry gelfoam® powder coats the esophagus in its downward passage. The results in one case were excellent. No amphojel or milk and cream is used in these cases.

Although the method as outlined is adhered to in a general way, each case is treated as an individual problem. The amount of blood given and the intervals between transfusions are varied with each patient depending upon the need. The only fixed and unchanged routine of treatment is the giving of the two tablespoonsful of gelfoam® powder and 250 units of thrombin every two hours. This is imperative in all cases treated. (Table 1.)

No patient was considered as having a massive gastroduodenal hemorrhage unless there was definite evidence that the case presented an acute emergency. Many of these patients were admitted in shock with blood pressure of 80/40. The red blood count in each of the aforementioned patients was under 2,500,000. If upon admission to the hospital the red blood count was 3,000,000 or more, the case was not considered as one of massive gastroduodenal hemorrhage. These patients were given gelfoam® and thrombin every two hours, as our severe cases, but the amount of blood given rarely exceeded 500 cc. in twenty-four hours. Often no blood was given at all. These cases were classified as having mild to moderate gastroduodenal bleeding and were not included in this series.

Four patients in this group presented a very dramatic clinical course. These cases are presented in more detail as follows:

TABLE 1
PATIENTS TREATED WITH GELFOAM® AND THROMBIN

Patient	Age	Sex	Diagnosis	Result
B. K.	37	M	Duodenal ulcer	recovered
R. G.	62	F	Duodenal ulcer	recovered
C. G.	61	M	Duodenal ulcer	recovered
W. B.	64	M	Gastric varices	recovered
B. Z.	66	F	Duodenal ulcer	recovered
B. M.	73	F	Gastric ulcer	recovered
M. B.	52	F	Duodenal ulcer	recovered
T. K.	31	M	Duodenal ulcer	recovered
B. E.	60	M	Gastric ulcer	recovered
L. Z.	46	M	Duodenal ulcer	recovered
K. J.	53	F	Esophageal varices	recovered
R. W.	48	M	Duodenal ulcer	recovered
T. O.	35	M	Duodenal ulcer	recovered
J. B.	72	M	Gastric polyp	recovered
S. L.	80	M	Duodanl ulcer	recovered
C. S.	33	M	Duodenal ulcer	recovered
A. Z.	41	F	Gastric ulcer	recovered
S. L.	65	F	Undetermined	recovered
S. C.	34	F	Duodenal ulcer	recovered
J. M.	45	M	Hypertrophic gastritis	recovered
C. G.	46	F	Duodenal ulcer	recovered
C. R.	50	M	Duodenal ulcer	surgery; died
T. M.	64	M	Duodenal ulcer	recovered
S. J.	65	M	Duodenal ulcer	recovered
D. J.	62	F	Duodenal ulcer	recovered
J. H.	64	M	Duodenal ulcer	recovered
F. O.	60	M	Duodenal ulcer	recovered
L. Z.	58	F	Henoch's purpura	recovered

CASE 1. L. Z., a fifty-eight year old white woman, was admitted to the hospital in shock. She was sent in because she collapsed following a massive gastric hemorrhage. There was no history of ulcer. Upon examination her pulse was 130; blood pressure was 84/40. There were definite signs of air hunger but no evidence of splenomegaly, hepatomegaly or abdominal varices. Red blood count was 1,640,000 and the hemoglobin 40 gm. She was given gelfoam® and thrombin every two hours with milk and cream. Upon admission 1,000 cc. of whole blood were given. In the forty-eight hours following admission she received 3,000 cc. of whole blood. With stabilization of circulation surgery was contemplated because of the severity of the hemorrhage. Blood studies showed the case to be one of Henoch's purpura. Gelfoam® and thrombin were continued since surgery was definitely contraindicated. The patient had an uneventful recovery.

Comment. This patient was *in extremis* when admitted to the hospital. Prompt and adequate blood replacement was undoubtedly

important for this emergency. A diagnosis of Henoch's purpura precluded any possibility of surgical intervention. Gelfoam® and thrombin were of undoubted value in controlling the gastric bleeding.

CASE II. R. W., a forty-eight year old white man, was admitted to the hospital following a massive gastroduodenal hemorrhage. He was known to have a duodenal ulcer. Blood pressure upon admission was 96/40, pulse 140, red blood count 2,370,000 and hemoglobin 48 gm. per cent. It was decided to treat this man with gelfoam® and thrombin alone without giving blood. A very close watch was maintained during the first twenty-four hours because no blood was being given. The purpose was to determine whether gelfoam® and thrombin alone would be sufficient to check the bleeding. The patient stopped bleeding promptly. Six days after admission his blood count was 3,380,000. Gelfoam® and thrombin alone as used in this case would have been unthought of early in our series but we were emboldened by the results obtained and decided to attempt one case with gelfoam® and thrombin alone.

Comment. This case suggests that gelfoam® and thrombin are of value as hemostatic agents in the control of gastroduodenal hemorrhage. The criticism that cessation of such bleeding was the result of adequate blood replacement would not apply in this case. No blood was given at all.

CASE III. L. Z., a forty-six year old white man, was admitted to the hospital for gastric resection for a known duodenal ulcer. At operation the duodenal ulcer was found to be on the posterior wall of the second portion of the duodenum. The surgeon considered it too dangerous to resect. A vagotomy and gastroenterostomy were therefore done. On the twelfth postoperative day the patient suddenly began to vomit bright red blood. Lavage of the stomach and aspiration were of no value. Blood transfusion was given but bleeding continued. A diagnosis of bleeding from the anastomotic site was made and reoperation considered. Gelfoam® and thrombin were then given in two tablespoonsful doses every hour. Within four hours the bleeding had completely ceased. An uneventful recovery followed.

Comment. The surgeon in attendance was definitely convinced that the gelfoam® and thrombin were responsible for the cessation of the bleeding in this case. Hemorrhage from the anastomotic site after gastrectomy or gastroenterostomy can be very dangerous. The condition of these patients is such that reoperation carries with it a high mortality rate. In a case of this type the use of gelfoam® and thrombin can be a life-saving measure because we are dealing with a fresh wound in the absence of an indurated ulcer presenting a sclerotic vessel.

CASE IV. C. R., a fifty year old white man, was admitted to the hospital with a massive gastric hemorrhage. His condition was considered extremely serious. Whole blood, 1,000 cc., was given and gelfoam® and thrombin started. Four hours later a diagnosis of exsanguinating type of hemorrhage was made and operation decided upon. At operation the ulcer was found to involve the second limb of the duodenum on its posterior wall. The area of induration was such that inversion of the stump did not seem possible. The branch of the gastroduodenal artery to the ulcer was ligated with the ulcer under direct vision. Bleeding ceased. An exclusion type of gastrectomy was then performed. The postoperative course was uneventful until the twelfth day at which time the patient vomited up a considerable amount of red blood. This bleeding continued despite adequate blood replacement. The patient died. At autopsy a large sclerotic vessel was found at the base of the ulcer. This was the source of hemorrhage.

Comment. This case was considered to be one presenting exsanguinating type of hemorrhage. In cases of this type if surgery is decided upon, it would appear most advisable to remove the ulcer. Massive hemorrhage from the ulcer remaining *in situ* in such cases is not rare. The use of gelfoam® and thrombin following an operation of this type is of no value as a hemostatic agent because the bleeding ulcer is in the proximal loop where the gelfoam® and thrombin cannot come in contact with it. All ingested material would pass through the gastric stoma into the distal loop. As a result the action of any hemostatic agent upon a bleeding ulcer following the exclusion operation is impossible.

CONCLUSIONS

Recent statistical reports indicate that a conservative approach to the case of a patient with a massive gastric hemorrhage is asso-

ciated with the lowest mortality rate. It must be admitted, however, that there is a small group of patients presenting markedly indurated ulcerations with an erosion of a large branch of a sclerotic gastroduodenal, left gastric or right gastric artery in whom continuation of a conservative form of treatment beyond twenty-four hours might be attended by a fatality. Since the mortality rate rises markedly after forty-eight hours in such surgically treated patients, it is imperative that in the first twenty-four to forty-eight hours the patient must be most intensively treated with every method short of surgery. The mortality statistics throughout the country report at the best a mortality rate of 5 per cent in the non-surgically treated group. Such patients are treated with bed rest, antacids, Meulengracht's diet or liquid diet and adequate blood replacement.

Although evaluation of hemostatic agents is difficult in those areas that cannot be directly visualized, the fact that twenty-seven consecutive patients were treated using gelfoam® and thrombin in addition to the usual form of therapy becomes significant only because all these patients recovered without surgery. It is true that the series is a small one. Twenty-seven consecutive cases of massive gastric hemorrhage without a single death would seem to suggest that the use of gelfoam® and thrombin was the deciding factor. In the one surgical death we do not believe that sufficient time was permitted for the action of this hemostatic agent. It is also quite true that in the presence of a large, sclerotic, eroded vessel at the base of an ulcer this hemostatic agent might fail. Time alone and the accumulation of a larger series of cases will answer this question. This is the purpose of the preliminary report so that such cases may be available in a reasonably short period of time to test the validity of our observations.

SUMMARY

1. Twenty-seven consecutive patients with massive gastroduodenal hemorrhage were treated with powdered gelfoam® and thrombin.

2. There were no deaths in the non-surgically treated group.

3. The use of gelfoam® and thrombin in cases of massive gastric hemorrhage appears to be a useful addition to our armament arium in such cases.

Addendum: Since this article was submitted for publication, forty-six additional patients with massive gastroduodenal hemorrhage were treated with gelfoam® and thrombin without a death. This makes a total of seventy-three consecutive patients treated in this manner without a death.

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SPINA BIFIDA OCCULTA*

A SURGICAL APPROACH

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BY far the greater number of cases of spina bifida occulta are completely asymptomatic. In fact the finding of a bifid spine in children is so common that Steindler[11] has postulated the diagnosis should not be made before the age of seven. It is the purpose of this paper to point out once again the central nervous system disorder present in those cases of spina bifida occulta with peripheral symptoms.

Symptomatic cases must show involvement of either the lumbar cord or the cauda equina. This may be due to traction exerted by a strong fibrous band which passes through the neural arch defect from the dura to the deep fascia, subcutaneous tissues and/or skin (Cases I and III), or by a space-occupying mass composed of tissue elements which have migrated through the unclosed neural arch into the neural canal. This migrant mass becomes adherent both to the dura and the walls of the neural canal (Case II). Both conditions, by fixing the dura and neural elements, prevent the normal cephalad progress of the cord which takes place during growth. In the second condition the element of pressure is added to that of traction to increase the possibility of permanent neural damage.

The clinical manifestations are subtle and varied. Loss or diminution of vesicle sphincter control may be the only complaint. This may range in severity from the annoying habit of bed-wetting to a true cord bladder with complete loss of control. Trophic changes of the lower extremities may be the presenting symptom. It is with these that Brickner[1] in 1918 had moderate success.

Developmental and congenital deformities in infants are frequently described in conjunction with spina bifida occulta.[2,7,12] The deformity that has been most generally described in this regard is the claw foot or cavus deformity.[4,8,9,10] This is most strikingly demonstrated in that type of case in which the deformity makes its appearance during early childhood, i.e., about five to eight years. Such a child may be first seen with a rather mild cavus deformity, and over a period of years this may be noted to progress in spite of all the usual treatment. In the most marked of such cases it may well continue until the deformity is indistinguishable from that of an old uncorrected clubfoot. More detailed examination may reveal other abnormalities as well as such sensory changes, muscle paresis and reflex changes. Even in the milder stages such patients may show rapid development of callosities and skin ulcerations over pressure points.

These cases in reality present a dynamic type of deformity and as such prove extremely difficult to correct locally; even when corrected they prove even more difficult to maintain. It is in just such cases, therefore, that consideration should be given to the possibility of correcting the pathologic condition centrally, i.e., at the site of the spina bifida occulta, if such exists. Pathologic studies and results from operation would tend to indicate that in patients exhibiting deformities at birth the damage has been accomplished in early intrauterine life and the involvement is probably irreversible.[3,5,6] In patients showing a late appearance of symptoms, however, one has cause to believe that the neural elements are for the first time being affected, probably due to the growth of the spinal column; and if any interruption of the deforming process is to be hoped for, it must be accomplished at this juncture. On theoretic grounds it would seem logical to think that the earlier such intervention was inaugurated the better would be the chance for obtaining relief. Later the changes in the nerve tissue may become irreversible and the deformity only amenable to reconstructive procedures.

CASE REPORTS

CASE I. R. T., a thirteen year old white girl, was first seen in July, 1945, complaining of inability to walk without support since birth. She

* From the St. Charles Hospital, Brooklyn, N. Y.

FIG. 1. Case 1. Deformities of both feet resulting from trophic disturbances.

had been a hospital inmate practically all her life. As an infant she was treated at another institution for a bilateral calcaneovalgus deformity, congenital dislocation of the left hip and spina bifida occulta. The treatment consisted of manipulations and applications of plaster casts.

When first seen she was walking with the aid of crutches. Examination revealed a right dorsal, left lumbar scoliosis, severe generalized atrophy of the left leg as compared to the right, flexion contracture at the left hip with restriction of all motion at the hip, limitation of motion at the left knee, and a bilateral calcaneocavus deformity of both feet. The distal phalanges of both big toes were absent and there was a deep trophic ulcer under the head of the fifth left metatarsal. (Fig. 1.) There was complete sensory loss over the dorsum of both large toes. The ankle and knee jerks were bilaterally absent. The left foot was noticeably cooler than the right. There was congenital dislocation at the left hip with the femoral head riding high on the ilium. The patient was incontinent of urine and had poor control of the rectal sphincter. There was a small tuft of coarse hair springing from a pigmented area of skin located over the upper sacrum. X-ray revealed spina bifida occulta of segments L_5 and S1 and 2. (Fig. 2.) In November, 1945, at open operation after traction the hip was reduced and shelf operation performed. Subsequently, the shelf partially absorbed but the patient was enabled to walk without crutches. She was then discharged. Because of persistent intractable ulcerations of the toes and feet she was readmitted, and on December 11, 1947, an exploratory laminectomy was performed.

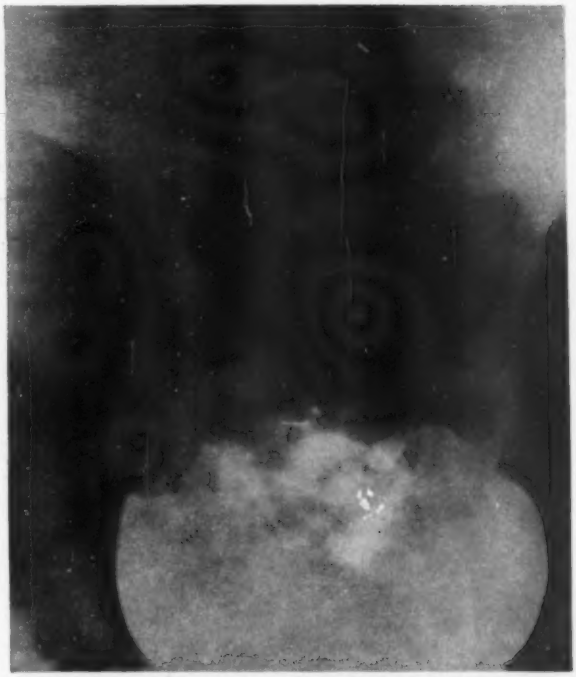

FIG. 2. Case 1. The large defect of the neural arch permitted the passage of a fibrous cord which caused a tenting of the dura.

At operation a 4-inch longitudinal incision was made over the lumbosacral region so that the pigmented nevus was at the mid-point of the incision. An easily identified strong fibrous band was found projecting from the underside of this pigmented area and was followed downward and cephalad for a distance of about 4 cm. It there entered the region of the laminal defect and being followed through this area was noted to penetrate the underlying dura. On opening the dura it was discovered that the fibrous band terminated by attaching at right angles to the filum terminale. (Fig. 3.) The entire substance of the fibrous band was then excised. There was no other evidence of any abnormality in the contents of the spinal canal. A soft catheter was passed up and around the cord and no indication of any obstruction was found. Postoperatively this patient made an uneventful recovery and subsequently did well while in the hospital. The nutrition, temperature and appearance of the skin of both feet improved markedly. Her incontinence and partial lack of rectal control improved steadily as they had been prior to operation. She was discharged six weeks postoperatively. On April 19, 1948, five months postoperatively, she returned to the clinic with a heavy callous under the head of her fifth metatarsal. There was a small necrotic

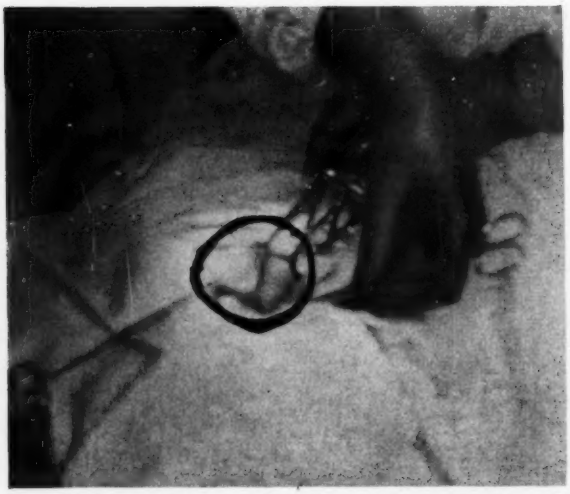

FIG. 3. Case I. At operation; the specimen consists of the skin dimple with its fibrous cord leading to the dura.

FIG. 4. Case II. The inversion and cavus of the left foot is clearly visible.

central area in the callous. This improved very slowly under treatment.

CASE II. P. P., a seven and a half year old white boy, was first treated at the St. Charles Hospital in July, 1943, at the age of three years for severe bilateral genu valgum. A bilateral supracondylar osteotomy was performed and the patient made an uneventful recovery. On routine follow-up examination in October, 1945, a cavus deformity of his left foot was first noted to be developing. Conservative treatment was initiated but by September, 1947, an advanced equinovarus deformity of the left foot had developed (Fig. 4) and an early cavus deformity was developing in the right foot. The patient was then admitted to the hospital.

The patient's history revealed a prolonged period of enuresis and urgency of urination was

FIG. 5. Case II. No demonstrable band led through the defect in the neural arch of S1.

still present. Examination showed a bilateral equinocavus deformity most marked on the left, a bilaterally positive Babinski, hyperesthesia over the distribution of the left peroneal nerve and x-ray evidence of spinal bifida occulta at S1. (Fig. 5.) The left os calcis was in marked varus and an attempt to correct this was made by means of lateral tendo achilles transplant. This was unsuccessful. Corrective plaster of paris casts with wedgings were then tried over a period of six weeks without avail. Pantopaque myelography was done without any findings to indicate abnormality. (Fig. 6.)

On February 26, 1948, an exploratory laminectomy was performed. The findings in the region of the spina bifida occulta were grossly normal as far down as the actual laminal defect. When this tissue and some surrounding bone was removed, it was discovered that the entire dura was covered with a heavy coating of brownish yellow fatty tissue. This fatty tissue was intimately attached to the outer surface of the dura throughout the entire region of the operative exposure; as far as was possible this tissue was removed although it was noted to extend beyond the available operative site. The patient made an uneventful recovery from operation. His subsequent course has been unremarkable; his foot deformities have remained as before and his bladder urgency is probably unchanged. Perhaps of some significance may be the fact that his foot deformities have not been noticed to progress since operation.

FIG. 6. Case II. The contrast medium shows excellent filling of the dural sac. The nerve roots appear to be normal in their course.

FIG. 7. Case III. There is a cavus of both feet with bilateral clawing of the toes.

CASE III. M. I., a seven year old white female, first came under observation in 1945. At that time she had acute anterior poliomyelitis with generalized involvement of both upper extremities, trunk and both lower extremities. She made a rapid and apparently complete recovery presenting no evidence of sequelae, all measurements and all muscle groups being symmetrically normal. In June, 1947, the patient began to complain of pain under the metatarsal heads of both feet. Shoe adjustments, rest and physiotherapy were instituted but nevertheless a rather severe clawfoot deformity developed bilaterally. (Fig. 7.) Markedly thickened deep keratotic areas appeared under the heads of the metatarsals and the patient's symptoms became so severe that she was unable to walk. In November, 1947, the patient was admitted to the hospital and after a period of bed rest corrective plaster of paris was attempted. However, there was no improvement. X-ray revealed spina bifida occulta at the region of L_5. (Fig. 8.) A spinal tap revealed normal manometric and laboratory findings. On March 11, 1948, an exploratory laminectomy was performed. Essential findings consisted of a small subcutaneous lipomatous mass over the region of L_4 to S_1. This was interlaced by dense fibrous bands and appeared to be transversed by one main fibrous band. Upon tracing this band it was found to enter the laminal defect becoming an integral part of a dense band that bridged the cleft. From the underside of this defect a strong band of fibrous tissue branched out to be attached to the dura. This band ran in a cephalad direction and traction exerted upon it caused the dura to move downward. These bands were completely excised. The dura was then opened and the contents noted to be normal in appearance and situation. Following operation the patient made an uneventful recovery. Her clawfoot deformity remains unchanged to date. However, her symptoms of pain have completely disappeared and the keratotic region under the metatarsal heads are

FIG. 8. Case III. The defect in the neural arch of L_5 permitted the passage of a fibrous band from the subcutaneous tissues to the dura.

entirely absent. She has been on a schedule of unrestricted activity, wearing metatarsal bars, and on this regimen is to date completely asymptomatic.

COMMENTS

The three cases presented herein most assuredly have yielded no dramatic results. However, in each case, having tried all the usual methods of treatment, the patients were still unimproved and progressing to further disability. Such an outcome naturally directed attention to considerations of some alternative approach in the further care of these patients.

Case I typifies the case with severe symptoms and marked deformities that is commonly agreed to have primary causative spina bifida occulta. It is our impression that few surgeons consider that any attempt should be made to ascertain whether a possibly correctible condition exists at the site of the spina bifida occulta. The patient in Case I has spent her entire life in the hospital under orthopedic treatment. Her deformities have in large measure proven refractory to all treatment, yet it was never proposed to explore her central lesion. At operation the filum terminale was found to be securely anchored at the level of her spina bifida at S1; and although this is no valid ground for supposing that her peripheral deformities would have been affected favorably had she been explored earlier, it is still more difficult to understand how such a condition can be completely ignored in the treatment of such a case.

In Cases II and III, which represent patients with late onset of deformity, there would seem to be more compelling reasons to consider exploration of the central defect seriously. It may be presumed that if corrected early enough there will not be time for any irreversible change to take place in nerve tissues; thus even if there cannot be complete restitution to normal, at least the progress of the condition can be halted. There is, likewise, some possibility that existing deformity may become amenable to corrective treatment once released from the deforming stimulus. It is with this type of case that many authors (Steindler, Campbell, Dittrick and others) have reported their most encouraging results.

In the cases reported herein and in some others under observation the clawfoot deformity has been the most prevalent and productive of the most troubling symptoms. This has likewise been the experience published by most authors who have written on this subject. There have been no satisfactory explanations to rationalize this occurrence but it is, nonetheless, the most common finding.

Such clawfoot deformities are by no means uncommon throughout the population of children's orthopedic clinics and are frequently seen with severe foot complaints in later life. Most of these are designated as idiopathic and little or no thought is given to the possibility of an underlying spina bifida occulta. It would seem that this anomaly must be considered in every case of foot deformity not otherwise explainable.

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SIMULTANEOUS FEMORAL HEAD FRACTURE AND TRAUMATIC HIP DISLOCATION

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IN the past two years I have seen four cases of simultaneous femoral head fracture and traumatic dislocation of the hip joint. I am, therefore, inclined to believe this combined injury occurs more often than review of the recent literature would indicate. Henry and Bayumi[1] reported in considerable detail thirteen such cases which they had collected from an apparently exhaustive search of the literature. King and Richards,[2] in a paper dealing with fracture dislocations of the hip, included one case of traumatic hip dislocation associated with fracture of the femoral head. Watson-Jones[3] and Key and Conwell[4] mentioned only treatment for the combined injury.

Etiology. To understand the mechanism producing simultaneous fracture and posterosuperior dislocation of the femoral head (Fig. 2) it is important to remember the construction of the acetabulum. Its heaviest portion is the superior rim. (Fig. 1A.) The strength and thickness of the acetabular rim decrease in descent and become practically deficient in the inferior portion.

Another important factor to consider in the production mechanism of this combined injury is the direction of the force which causes the dislocation. (Fig. 1B and 1C). The force must be transmitted through the longitudinal axis of the femur, and it must be of sufficient strength to dissociate the femoral head from the acetabulum.

If the hip is in 90 degrees of flexion when the force is transmitted, the femoral head is forced over the thin posterior acetabular rim. The result is the common posterior dislocation, with or without acetabular fracture. If, however, the hip is flexed not more than 60 degrees, the femoral head is impinged against the firm posterosuperior acetabular rim. Should the femur be in adduction, simple luxation results. However, if the femur is in the neutral or abducted position at the time the force is applied, combined dislocation and fracture of the femoral head occurs, with which this article is concerned.

Diagnosis. Each of my four patients with fracture dislocation of the femoral head was occupying the front seat of an automobile at the time of the accident and was suddenly

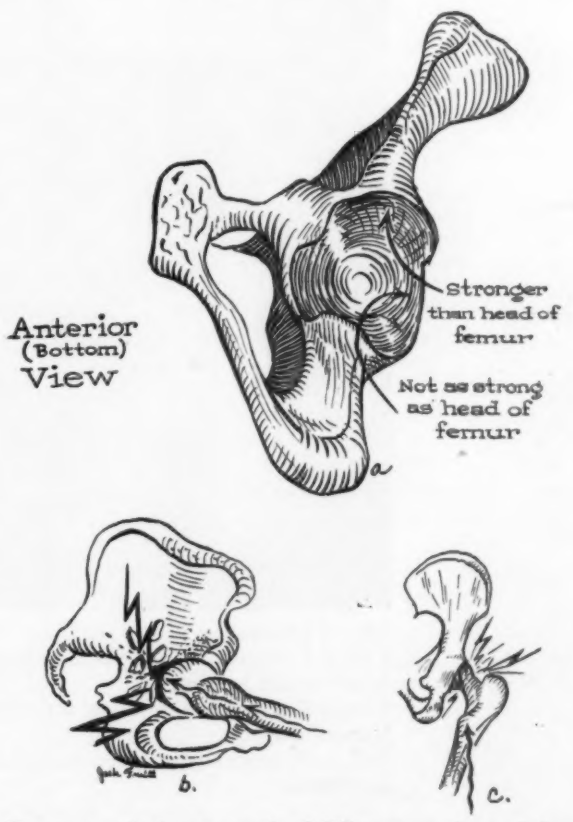

FIG. 1. A, relative strength of different portions of the acetabular rim; B, mechanism of production of acetabular rim fracture; C, mechanism of production of femoral head fracture.

thrown against the dashboard. The dislocated portion of the deformity was obvious on physical examination because of the typical adduction flexion and internal rotation position of the hip. Roentgen examination in each case disclosed the fracture defect in the dislocated

FIG. 2. Dislocation of femoral head with fracture of the inferior medial surface.
FIG. 3. Common example of dislocated femoral head with fracture of the inferior medial surface.
FIG. 4. Roentgenogram taken after closed reduction; note complete subcapital femoral fracture.
FIG. 5. Roentgenogram after successful closed reduction by traction with the hip flexed.

femoral head and the fracture fragment remaining in the acetabulum. (Figs. 2 and 3.)

Treatment. Dislocation of the hip associated with femoral head fracture, as well as uncomplicated dislocation, must be reduced as quickly as possible to minimize the complications arising from the resultant disturbed circulation of the femoral head. But return of the dislocated femoral head to the acetabulum and apposition of the fracture fragment are not easily accomplished in all cases. The detached fragment may prevent replacement of the femoral head to its normal place in the acetabulum, an experience reported by Satta.[5]

In my first case an abduction and external rotation manipulative maneuver was attempted. It resulted in complete fracture of the femoral head. (Fig. 4.) This hip was later treated with the Whitman reconstructive procedure. In each of the other three cases (Fig. 5) closed reduction was obtained by

gradual, continued, manual traction with the hip in 40 to 60 degrees of flexion.

The treatment after reduction had been accomplished, and the one which seemed rational to me, consisted of 10 to 12 pounds of skin traction applied with the hip in the extended position. Traction was continued for six weeks. After this period the patient was permitted to walk with the aid of crutches.

Each patient's progress was followed with repeated roentgenograms. These were deemed necessary to rule out femoral head necrosis. Six months after the accident, when roentgenograms showed there was no longer any danger of femoral head necrosis, weight-bearing on the affected hip was allowed.

Because of the regrettable complete subcapital femoral fracture brought about by abductory manipulation in the first case and the satisfactory results with manual traction in the other three cases, it appears to me that reduction should first be attempted by means of a gradual manual traction maneuver with the hip in flexion. If this procedure is unsuccessful, operative reduction should then be utilized.

Results. Primary treatment was obviously a failure in the case of the patient who had the subcapital fracture when abductory manipulation was attempted.

Simple traction easily accomplished reduction of the femoral head fracture dislocation of the other three patients. They all have painless weight-tolerant hips. The extremes of the motion range are limited a few degrees. Generally speaking, however, the condition of each patient is about what is expected in the average case of uncomplicated traumatic hip dislocation.

SUMMARY

1. Because I have seen four cases of concurrent femoral head fracture and traumatic hip dislocation in the past two years, it is my opinion that this injury is more common than is generally believed.

2. The first step in treatment should be a simple manual traction reduction maneuver. If this is unsuccessful, operative reduction should be carried out.

3. Early good results can be anticipated if reduction is accomplished and appropriate convalescent management is instituted.

4. Following reduction, weight-bearing should be disallowed until serial roentgenograms demonstrate that there is no danger of femoral head necrosis.

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CYSTOSARCOMATOID PHYLLODES*

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WE propose the term cystosarcomatoid phyllodes to describe a giant tumor of the breast believed to arise from a pre-existing fibro-adenoma[1] and having the potentiality of being either benign or malignant in character. Chelius first reported this tumor in 1828[2] calling it cystic hydatid. It was next described in 1838 by Johannes Muller who was the first to give this neoplasm the customarily used name of cystosarcoma phyllodes.[3] That much confusion exists regarding this neoplasm is evident when one considers that thirty different names have been employed to describe the 126 cases reported in the world literature. Some of the more descriptive names are cystosarcoma, hydatid tumor of the breast, intracanalicular papillary fibromyxoma, papilloma intracanaliculare, adenoma pseudosarcomatodes and giant intracanalicular myxoma.

Because of the multiplicity of terms used to designate this condition, it is desirable to establish a standard nomenclature. Since the term most widely accepted and used (cystosarcoma phyllodes) is misleading, we propose its modification, first, to cover the various pathologic types of the tumor, second, to retain the historic name phonetically and, third, to make allowance for the fact that the tumor may be either benign or malignant. Recalling that the word carcinoid is used to designate a neoplasm that may be either benign or malignant, the suggestion is made to add the Greek suffix, "oid," meaning similar to, to the word sarcoma. We would thus modify the term originally used by Muller and designate the tumor cystosarcomatoid phyllodes which should be acceptable both historically and pathologically. As the gross appearance of these tumors is well described by the term cystophyllodes, denoting a branching system of more or less parallel cysts resembling the veins of a leaf,[9] one readily understands the use of the term cystosarcoma arborescens.

The usual history obtained from the patient having this lesion is that several years previous to the development of the gigantic mass in the breast a small nodule was noted. This small nodule is presumed to be a fibro-adenoma. According to Lee and Pack[4] this fibro-adenoma exists for approximately seven years before becoming stimulated to excess growth. Once the stimulus occurs, the mass grows with extreme rapidity reaching a tremendous size in three to four months. Breasts up to 40 pounds in weight have been reported.[4] The average age of the patient having cystosarcomatoid phyllodes is forty-five and a half years.[4] It is rarely seen in the male and occurs most frequently in females who have had repeated births and lactations. Occasionally it is seen in an unmarried, childless woman.

A small percentage of patients give a history of trauma to their breast immediately before the period of rapid growth.[4] This was true in our patient. From the history it is presumed that an undetected fibro-adenoma was present before the trauma was received.

A review of the literature revealed 126 cases of this giant tumor. The majority of them were reported prior to modern efforts at diagnosis and treatment.[5] With the early removal of lumps in the breast for diagnosis or therapy it is presumed the incidence of cystosarcomatoid phyllodes will be decreased in the future.

Usually the breast is markedly enlarged with an encapsulated, nodular tumor and without retraction of the nipple or involvement of regional lymph nodes. Since the tumor is commonly cystic, some superficial cysts may be palpated. This accounts for fluctuant areas in a massive, firm tumor. There may be dilated, engorged veins over the surface of the breast and the skin is typically taut, atrophic, thin, red and shining. In some cases due to pressure necrosis there may be skin ulceration which gives an impression of malignancy. The average weight of these tumors is 3,600 gm.

Few or no constitutional symptoms are evident, the only complaint being directed

* From the University of Missouri School of Medicine, Columbia, Mo.

FIG. 1. Microphotograph showing the benign histologic appearance of cystosarcomatoid phyllodes.

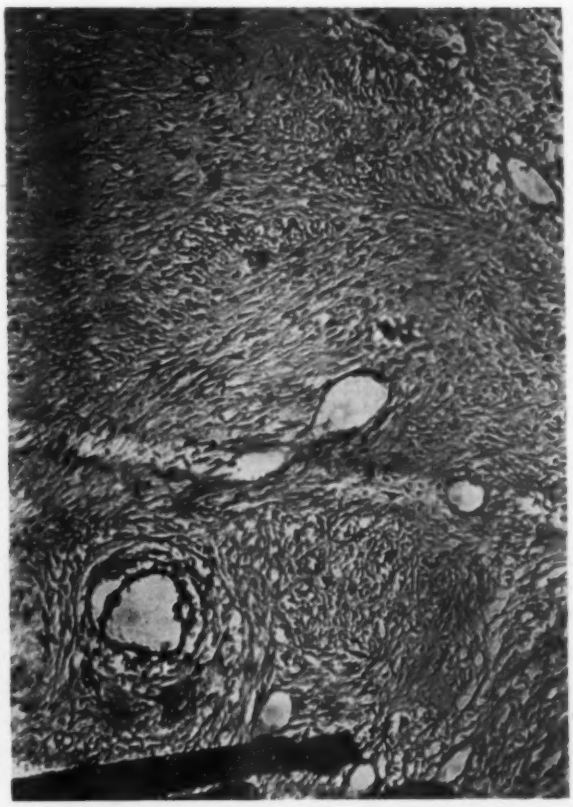

FIG. 2. Shows the benign histologic appearance of cystosarcomatoid phyllodes.

toward the unusual size and weight of the breast. Pain is not present as a rule but may be present as the result of the sustained sagging weight.

The findings from external examination of the breast have been described. On surfaces by section an encapsulated tumor not involving the skin or nipple is seen. Hemorrhagic areas are commonly noted throughout the tumor. Cystic spaces sometimes grouped similar to a chain of lakes and containing a brown fluid or coagulated material are also present. Some cysts break into adjacent ones and have stubs or remnants of broken walls projecting into their lumen. An extensive fibromyxomatous appearance is found in some of these tumors.

Histologically, the picture is varied. In the benign types the elements are myxomatous and fibrous in character and no mitoses or other suggestions of malignancy are apparent. The tissue is of adult form and development. Reactive cells and hyaline deposits may be present in some areas. In general, the ducts and glands appear tortuous and some are of bizarre shape. In certain areas invaginations of fibrous or myxomatous tissue give an intracanalicular appearance and in others these show a pericanalicular type of distribution. (Figs. 1 and 2.)

The malignant forms often reveal areas entirely benign in appearance intermingled with areas in which there is cellular hyperchromatism with the presence of mitotic figures, some tendency to cellular pleomorphism and peripheral invasiveness, even into muscles.

The generally benign course of cystosarcomatoid phyllodes has been emphasized in many articles.[1,4,6] However, it is evident that in a few cases the tumor does not remain benign but becomes definitely malignant, metastasizes and even recurs locally.[7]

At the present time there is no reliable way to predict the course of this neoplasm. Notwithstanding this fact, wide excision of the tumor including the pectoral fascia but without radical mastectomy is deemed sufficient treatment for the majority of cases.[5,6] However, if there is muscle invasion, a radical dissection should be performed.[7,8]

CASE REPORT

R. L., a forty-eight year old white housewife, entered Boone County Hospital September 3, 1948, with the chief complaint of "a massive breast." Four months previously her husband had accidentally struck her left breast and a short time later a tumor that showed rapid growth was noted. There had been no pain, tenderness or other complaint except that referable to the extreme weight and size of the breast. It is of interest to note that this patient saw a doctor for the first time about this tumor only one week before her hospital admission.

Physical examination revealed an obese white female in generally good health except for blood pressure of 190/90 and a slightly enlarged heart. The right breast was pendulous but no masses were palpated. The sagging left breast was colossal in size and a painless, non-tender, firm, large, tumor-like mass, not attached to skin or muscles and rather movable, involved the lateral portions. Superficial vessels were dilated and the skin over the tumor was red, stretched and shining. There was no nipple retraction or pigskin appearance. No regional lymph nodes were palpable.

Roentgen examination of the chest was negative for evidence of pulmonary disease or metastasis. The blood and urine findings were not abnormal.

On September 8, 1948, a radical mastectomy was performed. She had essentially an uneventful postoperative course and had no evidence of recurrence or lymph node involvement at the end of ten months.

The pathologic findings were as follows: Anatomically, a colossal breast with muscles was seen weighing 6,960 gm.; the skin was largely red to bluish with bran-like desquamation of surface epithelium. A massive tumor, not adherent to skin, distinctly defined and limited from surrounding tissue, constituted the major structure. Surfaces by section had a white to opalescent bluish fibromyxomatous appearance with areas of recent hemorrhage and multiple spaces containing a brownish fluid or, in a few, a coagulated material. In the surrounding fat there were other areas of hemorrhage. Histologically, a typical organoid tumor of myxomatous, fibrous and glandular elements bearing areas of edema, semi-recent and recent hemorrhage was seen; some of the glands showed cystic changes. There were some reactive cells, chiefly lymphocytes and plasma cells, present and these appeared around vessels as well as within glands. The diagnosis was cystic and edematous adenomyxofibroma (cystosarcoma phyllodes).

SUMMARY

1. The 127th case report of cystosarcoma phyllodes is presented.

2. A modification of the historic name to cystosarcomatoid phyllodes is proposed to allow a more accurate pathologic connotation.

3. A review of the signs, symptoms, prognosis and pathologic findings for this tumor is given.

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FRACTURES OF BOTH BONES OF THE FOREARM

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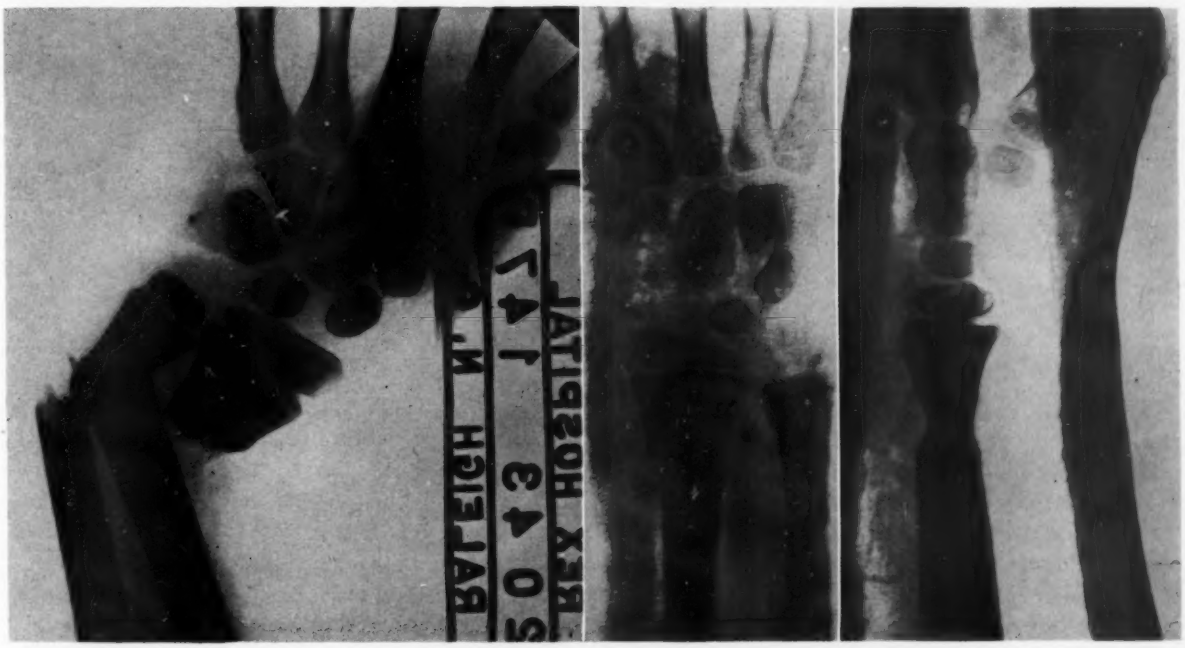
THIS report is offered with no idea of presenting an original technic but as a recapitulation of an old one which has in our hands provided a very successful way of dealing with a troublesome and often difficult problem. This technic has made it possible for us to avoid in almost all cases the undesirable necessity of open operation on fractures of both bones of the forearm.



1A 1B

FIG. 1. A and B, typical fracture of both bones of the forearm with displacement and overriding; the extreme difficulty often encountered in this type of fracture in obtaining and maintaining proper reduction while plaster is being applied is completely eliminated by the use of mechanical traction.

In children these fractures demand only one essential therapeutic maneuver, namely, nonconstricting immobilization of the fracture in normal alignment. It should be emphasized that anatomic reduction in children twelve years of age is not essential to a good result since in these cases, when good alignment is attained, a normal anatomic relationship will almost invariably result. This is, however, far from true in the adult when anatomic apposition of the fractured fragments is desirable and in most cases essential.

In every respect the chief difficulty in obtaining good, immobilized reduction in these fractures is that of maintaining traction and position while plaster is being applied. The method of reduction under the fluoroscope is slippery, tedious, unsatisfactory and ill-advised, since with the method a good reduction is physically difficult, maintaining it while plaster is being applied troublesome, the trauma to the soft tissue undesirable and the repeated use of the fluoroscope dangerous to the operator.

The method we employ is used for all fractures of both bones of the forearm with displacement, including those cases of compound injury in which the soft tissue damage is not of such degree as to demand débridement. Of approximately 100 patients so treated there have been only two who subsequently required open reduction, and in both these patients there had been over a week's delay in the institution of treatment. (Fig. 1.)

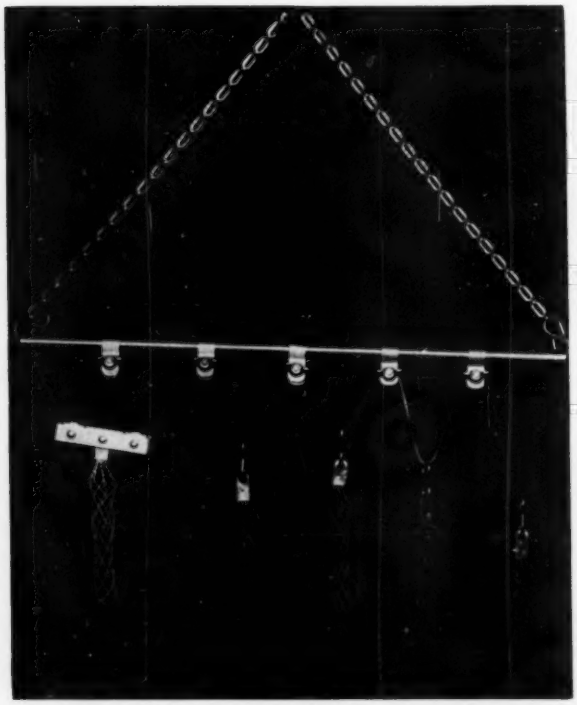


FIG. 2. By slight change in the placement of the chain of the hanger in relationship to the tie to the overhanging bar there can be effected unequal radial or ulnar pull as may be necessary in the individual case.

FIG. 3. The traction apparatus illustrated is simple, durable and convenient. It is not essential to the method, however, since muslin and adhesive can satisfactorily be used to attach the hand to the overhanging bar.

The method is as follows: The patient is anesthetized, ordinarily with ether if the patient is under five years of age, sodium pentothal® if the patient is over five years old. The shoulder of the involved side is brought to the edge of the stretcher, the upper arm is abducted horizontal to the floor and perpendicular to the stretcher, the elbow is flexed at right angles and the hand is affixed to an overhanging bar at the height permitting such an angle. (Fig. 2.) The fixation of the hand may be obtained by the use of adhesive tightly wrapped around the palm, including the base of the thumb, and muslin strips attached under the adhesive tied to the overhanging bar, or better, by the use of the Chinese finger tractor.* (Fig. 3.) A plaster bucket, the 10-quart size, is suspended from the horizontal upper arm by a muslin strip over sheet cotton padding, and water is poured into the bucket to the weight necessary for reduction, usually from about one-half to three-quarters of a bucketful. After ten minutes of traction, the forearm is moulded with the operator's palms and fingers into normal alignment. This is easily attained by tactile pressure along the interosseous membrane and by the correction of bony displacements palpable along the borders of the arm. Check-up x-rays are then made with a portable machine. When the fractures are compound, the skin is thoroughly cleansed with soap and water, ether and merthiolate, and a sterile vaseline and sheet cotton dressing is applied. The base of the hand, the forearm and upper arm are swathed in sheet cotton, and a snug circular plaster cast applied. Care is taken that it cuffs the hand and the base of the thumb for at least 1 inch and extends above to near the axilla. Traction is maintained until the plaster has set, at which time the muslin strip is withdrawn from the plaster on the upper arm and the defect repaired with more plaster. Several hours after the plaster has set, the cast is cut but not spread throughout its entire length. The hand is, of course, watched for circulatory impairment; and in the event such impairment ensues, the plaster is spread uniformly through its length with spreaders to the extent necessary to allow for adequate improvement of the appearance of the hand. Those pa-

* Designed and manufactured by Siebrandt Manufacturing Co., Kansas City, Mo.

tients in whom the injury is a compound one receive both penicillin and sulfadiazine for about a week. The cast is usually left on for from four to six weeks, depending upon the age of the patient, at which time it is removed, check-up x-rays taken, and in the event healing permits, physiotherapy begun.

The method described herein has also been very satisfactorily used for other displacements requiring traction for their reduction as, for instance, dislocation of the wrist semilunar. A pertinent rule in its use in these cases is to wait out ten minutes of traction patiently before manual manipulation is undertaken.

HYSTEROSALPINGOGRAPHY has been extensively used to diagnose the patency, or lack of patency, of the fallopian tubes. Until very recently, however, no one thought of studying these films to ascertain the actual type of pathologic involvement of the tubes. Now, certain authorities claim that they can diagnose tuberculous salpingitis (and have their diagnosis confirmed by postoperative histologic study) if finely ragged contours with small lumen effects are found in the salpingograms of said tubes, since tuberculosis causes a slight folding and swelling of the tubal mucosa. Some other salpingograms, on the other hand, demonstrate another and allegedly characteristic picture in tuberculous salpingitis. In these latter the tubal lumen presents a rigid and straight contour often resembling a pipe. According to W. Magnusson, both of the aforementioned salpingograms are very suggestive of a tuberculous etiology. This appears to be an interesting field for radiologists and gynecologists but obviously the final word has not yet been said on the characteristic radiographic appearances, if there are any, of tuberculous salpingitis. (*Richard A. Leonardo, M.D.*)

PARAVESICAL EXTRAPERITONEAL CESAREAN SECTION TECHNIC

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THE termination of labor which has been in progress for many hours, often complicated by a prolonged period of ruptured membranes and whose clinical classification is that of potential infection, remains even at the present time a formidable obstetric procedure. Proof for this statement is had when one surveys the list of diverse operative procedures recommended and urged for meeting such emergencies, namely, (1) difficult delivery through the birth canal with its attended compromise of fetal life on the one hand and extensive soft part injury on the other; (2) craniotomy on the living child, mentioned only to be condemned; (3) some form of peritoneal exclusion-cesarean section technic (never a popular procedure and anatomically unsound because one does not truly exclude peritoneal contamination); (4) cesarean hysterectomy, an unnecessary sacrifice to impose upon a young, healthy female because she happens to have a longer than average labor demanding operative termination and (5) transperitoneal cesarean section.

In discussing transperitoneal cesarean section as an elective method in the management of the potentially infected parturient some distinction should be made between those patients in whom "dystocia or prolonged labor is anticipated" and operation is performed more or less electively with little or no labor and no rupture of membranes, and those patients who during an established prolonged labor are given antibiotics and sulfonamides prophylactically and then come to transperitoneal cesarean section. We believe that not one of the foregoing procedures is sound or justified if one has available an alternative solution to the problem which has been proven surgically safe and anatomically sound. We believe that all labors complicated by the presence of potential infection of the amniotic sac demand as a universal minimum antibiotic and sulfonamide therapy prophylactically throughout the entire labor, sufficient parenteral fluid, proper and adequate sedation, and if the labor must be terminated by an abdominal approach, the utilization of an extraperitoneal cesarean section. In the operative management of such a potentially infected parturient we can not understand how there can be anything but complete agreement with the statement that the interests of such a patient are best served if the procedure is carried out extraperitoneally without exposure or invasion of the peritoneal cavity. This, as we see it, is a surgical truism which permits of no argument.

The one factor which has hampered the more widespread utilization of extraperitoneal cesarean section in potentially infected cases is the alleged increased technical difficulty in its performance. This attitude seems now to have brought the ultimate alternate choices to cesarean hysterectomy and transperitoneal cesarean section with the liberal intrapartum exhibition of antibiotics and sulfonamides prophylactically.

Some time ago, one of us (J. F. N.) offered and described a paravesical extraperitoneal cesarean section technic and claimed for it, among other things, ease of performance. We based this conclusion on experience gained in the teaching of the operation to the resident staff and, in addition, demonstrating it at various times to others interested. We supported our convictions still further by some statistical proof. Our subsequent experience with the operation has emphasized two technical points which we believe are worthy of reporting for they add much to the facility with which the operation may be performed. Every extraperitoneal cesarean section, no matter what technic is employed, is a retrovesical infraperitoneal exposure of the lower uterine segment. The paravesical technic which we have employed permits of an easy, facile, rapid exposure of that area.

Before entering upon any description of the technical steps in the operation emphasis is placed upon the importance of adequate

knowledge of the pelvic areolar tissue or fascia and the relationship of the anterior and the posterior peritoneal folds to the bladder and lower uterine segment, respectively. For an excellent anatomic description of these layers of fasciae and the peritoneal folds, reference is made to the publication of Ricci and Marr.[2]

We wish, also, to stress the fact that since the entire dissection phase of this technic is a fascial plane dissection or, probably more accurately expressed, is carried out through the different layers of pelvic areolar tissue, the exhibition of 2,000 cc. of parenteral fluid within four hours prior to operation will make the tissue easier to handle and to remove (1) from the bladder and (2) from the lower uterine segment. We hold this preoperative use of intravenous fluids to be of considerable importance.

After the bladder has been filled with 200 to 225 cc. of any colored sterile fluid and a retention catheter has been left in the bladder, a left paramedian skin incision is made from approximately 2 cm. above the distended bladder down to the symphysis pubis.* The anterior sheath of the left rectus muscle is exposed and incised for a similar distance. Kocher clamps are applied to the medial border of this incised sheath and the left rectus is bluntly removed by finger dissection from the underlying distended bladder. The left rectus muscle is lifted up and retracted laterally by means of a Fritsch retractor.

The first important anatomic landmark is an area of chicken yellow fat tissue along the left border of the bladder. This is exposed and identified. By inserting the middle and index fingers into this fatty tissue (which apparently represents a weakened area in the perivesical fascial capsule) the anterior layer of this fascial capsule can be easily lifted up and away from the bladder. We originally advised and described incision with scissors downward and inward in the direction of the symphysis pubis of this fascial capsule. Recently one of us (E. M.) demonstrated that by continued gentle digital traction on this anterior sheath of perivesical fascia the anterior surface of the bladder may be easily, rapidly and most satisfactorily denuded of its anterior fascial capsule covering, and the distended bladder will be "popped out of" or permitted to herniate through the hiatus thus created. This procedure does not lay bare and expose to injury the bladder musculature.

The bladder must then be emptied. This done, one proceeds bluntly to remove this viscus from the underlying uterus and thus gain access to the uterus. Removal of the bladder can most surely and expeditiously be carried out in the following manner: Blunt removal of the organ is begun at its left upper pole, using gentle downward and inward traction through the medium of a gauze pad. An additional technical point, as yet unpublished but which has aided us considerably and which will facilitate greatly this entire procedure of gaining retrovesical access to the lower uterine segment, is identification of the left impervious hypogastric artery as it ascends along the left side of the bladder to its summit. All the time remaining lateral to this impervious hypogastric artery and utilizing continuous and gentle traction on the bladder in the direction of the symphysis, a sufficient area of the retrovesical lower uterine segment will be brought rapidly and easily into view.

Almost simultaneously as the result of this maneuver the posterior peritoneal fold will be exposed lying upon the lower uterine segment. The area of lower uterine segment thus exposed will be roughly triangular in shape, the upper border of which is composed of the posterior peritoneal fold, the lower mesial border by the partly removed bladder and the lateral border by the parietes. By picking up with Kelly forceps the fascia in this bared triangular area and incising it one can then with Richardson retractors, as originally described, retract the posterior sheath of this peritoneal fold upward and the bladder downward and mesially and thus gain sufficient exposure of the lower uterine segment to permit the placing of a vertical incision in the uterus, practically in the midline. Sufficient room will thus be gained in the retrovesical infraperitoneal portion of the lower uterine segment to permit relatively easy delivery of a more than average-sized baby. It is emphasized here that the margin of safety which permits such traction bluntly to remove the posterior peritoneal fold upward and the bladder downward is the buffer effect obtained from the combined

*Note: We are now omitting this step of filling the bladder and find the procedure is just as simple on the empty bladder.

posterior sheaths of the perivesical fascia plus the anterior sheath of the periuterine fascia.

An important technical step in the utilization of this operative procedure is the manner in which one effects delivery of the fetal head. Having made the aforementioned vertical incision in the exposed and enlarged retrovesical infraperitoneal portion of the lower uterine segment, the operator inserts his hand into the cavity of the uterus, and the face if it is not already anterior is manually rotated anteriorly. This is easily accomplished by placing a finger in the baby's mouth thus effecting rotation.

Any standard type of obstetric forceps is then applied to this anterior face in such a manner that the lock is at the chin and the concavity of the cephalic curve is directed upward. Before any traction is initiated, the chin is manually lifted out of the uterus and up over the upper angle of the incision; then traction is instituted and by alternate flexion and extension the head is eased out of the uterus with the forceps still applied.

It has been possible by this method to deliver babies weighing 6,000 gm. with no extension of the uterine incision, with no injury to the peritoneum and with no damage to the bladder. We are inclined to believe that the initial act of lifting the chin up and out of the uterus before any traction is made on the forceps is a very important step in the technic. We have encountered no special difficulty with breech presentations. They are managed usually by delivery of the anterior leg first and on completion of the delivery of the breech traction is made downward in the direction of the foot of the table. As a rule we have not used forceps to the after-coming head.

During the three-year period from 1945 through 1947, 973 cesarean sections were performed at the Margaret Hague Maternity Hospital. Of these, 539 were transperitoneal lower uterine segment operations, 244 were paravesical extraperitoneal cesarean sections, 145 were supravesical extraperitoneal cesarean sections and twenty-six other extraperitoneal cesarean sections. (Table 1.)

The paravesical group refers to the operations performed in accordance with the technic described in our original publication with the addition of the modifications set forth herein. The supravesical group identifies those operations performed in accordance with the technic described by Waters.[3] The other sections in this group identify those extraperitoneal cesarean sections which follow neither one nor the other of the foregoing technics. The over-all cesarean section incidence in 1945 was 3.8 per cent, in 1946 3.9 per cent and in 1947 4.4 per cent. These figures will attest to the widespread utilization of this paravesical type of extraperitoneal cesarean section in our clinic.

TABLE 1*

Type of Cesarean Section	1945	1946	1947	Totals of 1945–1947	
Low uterine segment	159	166	214	539	55.4%
Extraperitoneal					
Paravesical	41	80	123	255	25.0%
Supravesical	31	46	68	145	14.9%
Other	6	12	8	26	
Classical	7	2	2	11	
Cesarean hysterectomy	1	1	6	8	
Total cesarean sections	245	307	421	973	

* The figures in this table and Table II are for the three-year period indicated and do not pretend to be any more comprehensive than outlined.

Table II is a statistical breakdown of all the so-called operative difficulties encountered in all extraperitoneal cesarean sections, 1945 through 1947, and indicates the percentage as identified with the various types of extraperitoneal cesarean section technics. We believe that these tables, indicating our most recent and current experience with the extraperitoneal cesarean section, quite unerringly point

TABLE II
OPERATIVE COMPLICATIONS (1945–1947 BOTH INCLUSIVE)

	Paravesical	Supravesical	Other
Bladder Puncture			
Once	0	3	1
Twice	0	1	0
Peritoneal Punctures			
Once	35	14	7
Twice	2	9	3
Three times	1	3	1
Total bladder and peritoneal punctures	38	30	12
Percentage operative complications	38 in 244 15.5%	30 in 145 20.6%	12 in 26 46.2%
Maternal deaths	0	1	0

up the easy accessibility and increased margin of safety of this type of operation as a method of management for the operative termination of labor in the presence of potential infection.

Extraperitoneal cesarean section obviates the trauma, the hemorrhage and disability dependent upon or subsequent to difficult vaginal delivery. It relegates to its proper place, oblivion, craniotomy of the living child. It possesses vast superiority over the rarely used and not superior exteriorization type of cesarean section. It leaves the patient with whatever physical and psychical advantages may accrue to a woman who has the satisfaction and knowledge that she still possesses her uterus. It renders negligible the incidence of postoperative peritoneal adhesions and their subsequent potential dangers for it leaves the patient with an undisturbed, unsullied peritoneal cavity or with what perhaps may be more aptly called a virginal peritoneal cavity (most certainly not an insignificant item when one recalls some of the remote sequelae to peritoneal adhesions).

SUMMARY

We offer two additional technical modifications to our previously described paravesical extraperitoneal cesarean section technic. We believe that this operation is easy to perform and well within the technical competence of the average obstetric surgeon. It requires no extraordinary degree of surgical skill. Since 1945 the paravesical extraperitoneal cesarean section herein described has been the most widely utilized of all extraperitoneal cesarean section technics at the Margaret Hague Maternity Hospital. It has a wider margin of safety and a greater ease of performance than any previously described type of extraperitoneal cesarean section, as evidenced by the lower incidence of operative difficulty encountered and its proven ease of performance.

The shortest time consumed in carrying out the dissection phase of this operation from incision of the skin to delivery of the baby has been less than five minutes on several occasions; it has been consummated many times in less than six minutes. An over-all average time is between eight and ten minutes. This time element, admittedly unimportant, is mentioned to prove one thing, namely, that the dissection feature of the operation which is considered to be the most troublesome, intricate and complicated technical facet in extraperitoneal cesarean operation cannot be too technically difficult here if it requires so short a time.

All the objections but one heretofore raised against the utilization of extraperitoneal cesarean sections have long since been abundantly disproved; the remaining one is the difficulty of performing the operation. We believe that in offering this paravesical extraperitoneal cesarean section we can negate arguments against its difficulties, and we present for acceptance statistical proof in support of this view.

In a total of 244 paravesical extraperitoneal cesarean sections performed in 1945 there was no bladder injury and, of course, no permanent vesicovaginal fistula; there were thirty-eight peritoneal invasions and no maternal deaths. No major operative complications were encountered; there were no extensions of the uterine incision into the broad ligament, no massive infection of the pelvic cellular tissue and no injury to any bladder in the vesicovaginal area. There were no serious postoperative infections. No patient was left with the potential residuum of postoperative peritoneal adhesions.

A description is offered of the manner in which one effects delivery of the fetal head with standard type forceps. This has made possible the delivery of babies weighing up to 6,000 gm. without extension of the uterine incision, with no injury to the peritoneum and with no damage to the bladder.

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ARTHRODESIS OF THE HIP

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IMMOBILIZATION of the hip postoperatively after arthrodesis has never been completely satisfactory. Casts produce stiffness in neighboring joints and necessitate prolonged inactivity with its attendant dangers. Cast fixation is not absolute, especially in obese patients. A nail alone has been used frequently but seldom maintains the hip in the position in which it is placed at the time of operation; the end results are frequently unsatisfactory.

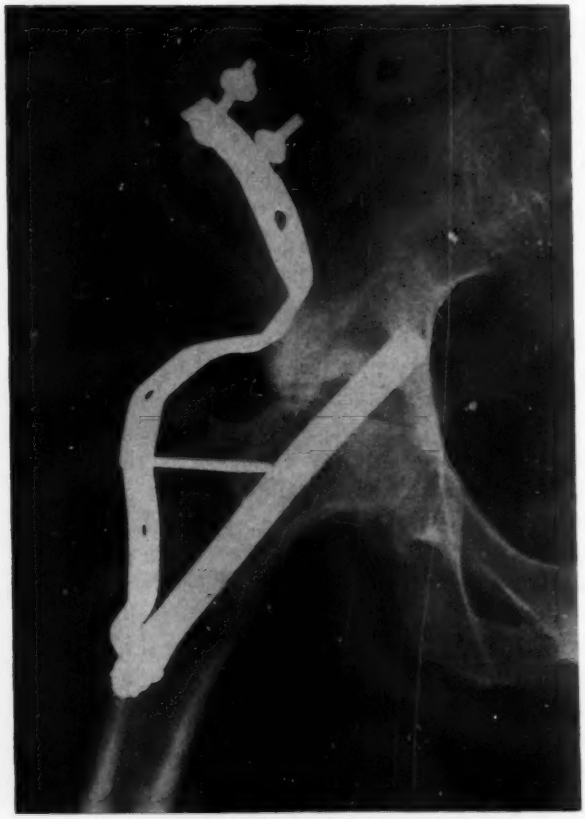

FIG. 1. Internal fixation for hip arthrodesis.

The accompanying x-ray really needs very little in the way of text. (Fig. 1.) The triangular stability of this internal fixation is readily apparent. In the illustrated case a pie-shaped piece of bone was taken out of the upper surface of the head and the adjacent surface of the acetabulum so as to put the hip into satisfactory position. The nail is an Altenburg nail. The plate is secured to it with a hexagonal nut so that the danger of its coming loose is extremely slight. It was thought that two bolts through the ilium were preferable to one because of the softness of the iliac bone. The plate was bent into approximate shape with bending irons, before the operation, and minor corrections were made in its shape at the time of the operation. No cast was put on and no fixation of any kind was used. The patient was allowed to move about in bed at once and could do so readily. Partial weight-bearing with crutches was permitted in three weeks. Full weight-bearing without assistance was permitted in six weeks. In later cases the plate has been bridged across from the trochanter to the ilium. This simplifies the technic and lessens trauma.

It is believed that this method makes arthrodesis of the hip a much less formidable and more certain procedure and materially extends the age limit at which it can be justifiably attempted.

This procedure has been carried out in five cases. There was one failure due to infection which necessitated the removal of the internal fixation before arthrodesis occurred. It is believed that this case in no way detracts from the soundness of the mechanics of this internal fixation. In one case the patient was somewhat senile. He became irrational and got out of bed and walked on the fifth day and again at three weeks with no assistance. Rigid fixation was not disturbed and the hip proceeded to arthrodesis. His mental confusion cleared up when he went home.

INNER TABLE OF ANTERIOR ILIUM, A CONVENIENT BONE DONOR SITE FOR GRAFTING

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OCCASIONALLY it is desired to graft bone to the forearm, upper arm or clavicle and allow the patient to become ambulatory the next day or so. Experience with usual donor sites such as the tibia, outer table of ilium either anteriorly or posteriorly or superior surface of the anterior iliac crest has shown that most of these patients need to be kept in bed for several days or weeks following the grafting procedure. A convenient site from which to take this bone and allow early walking has been the inner table of the anterior half of the body of the ilium. It is safe after using this site to allow the patient to be ambulatory the day following operation, with minimal pain and discomfort and no untoward complications.

A straight incision is made over the anterior 3 inches of the crest of the ilium. The incision is carried down to the mid-width of the crest of the ilium. The periosteum and insertion of external oblique muscles are reflected medially off the surface of the ilium at its crest, the dissection being carried posteriorly 2¾ inches along the crest and then medially into the pelvic cavity. One need only stay above the level of the antero-inferior spine in order to be 1 inch above the acetabulum. It is not possible to carry dissection further posteriorly since the two outer cortices of ilium are so thin beyond

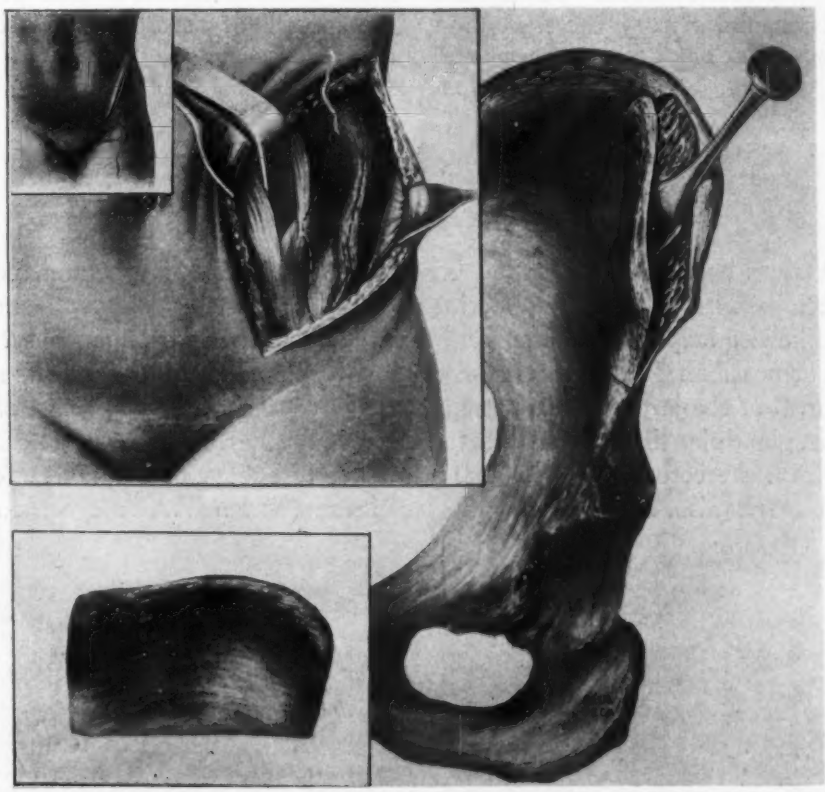

FIG. 1. Inner table of anterior ilium yields a bone graft 2¾ inches by 1¾ inches with additional cancellous bone chips from beneath the overhanging superior ridge.

that point that an aperture or window results in the wing of the ilium if more bone is removed. In this manner a cortical bone graft can be obtained measuring $2\frac{3}{4}$ inches long and $1\frac{3}{4}$ inches wide. Many additional cancellous bone chips can be taken from beneath the overhanging crest of ilium. Some additional ones can be obtained from the anterior margin of the ilium running down toward the antero-inferior iliac spine. No cancellous chips can be removed further posteriorly and deeper in the wing of the ilium due to the thinness of the bone. Technically the procedure is easier on the right ilium for a right-handed surgeon. (Fig. 1.)

There is a minimal amount of postoperative pain and all the patients operated upon by this method have been ambulatory the next day. The only complication has been an occasional hematoma, relieved by aspiration. The inner table bone makes excellent onlay grafts for bridging bone defects in the forearm, humerus and clavicle. They have been used in addition in the lower end of the femur and in the foot and have served, when cut up into small chips, as bone to fill cystic cavities. Accessibility to the anterior ilium is easy since the patients with bone grafts to clavicle and extremities lie supine on the operating table. Removing the inner table does not change the external bony confirmation of the anterosuperior spines and crest of ilium.

The speed with which the graft can be obtained, the relative safety of stripping off inner table periosteum and peritoneum and the absence of postoperative pain and discomfort recommend the procedure.

OFTEN endometriosis can be controlled by conservative management, especially with the use of endocrine therapy. Properly spaced pregnancies are likewise helpful. When surgery is indicated, it should be as conservative as possible. Often resection of the involved portions of the ovaries and removal of the larger implantations will suffice to relieve symptoms, after which glandular therapy is indicated to prevent recurrences. In other cases, a total hysterectomy suffices. It is a mistake to believe one has to remove both ovaries also. Hysterectomy alone can cure. (*Richard A. Leonardo, M.D.*)

Modern Operative Technics

No. 2

RECENT IMPROVEMENTS IN RESECTION OF THE MAXILLA*

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Baltimore, Maryland

RESECTION of the maxilla is generally considered to be a formidable undertaking, but in recent years improvements in technic and reduction in operative mortality have made it an operation of increasing usefulness.

Malignant tumors of the maxilla continue to constitute the principle indication for this operation. These tumors may arise in bone, may be squamous carcinomas of the alveolar ridge epithelium or may be adenocarcinomas of the sinus epithelium. It now seems that this operation may prove useful in the treatment of radionecrosis of the maxilla or osteomyelitis of pyogenic or tubercular origin. We have treated a few such cases with good results when combined with chemotherapy. The technic of this operation dates back many years and contributions by Bloodgood, McFee and König have been of much value.

The advent of chemotherapy, blood transfusions and endotracheal anesthesia reduced the operative mortality to an inconsequential level. Attention was turned to the remaining complications of such resections which were as follows: (1) postoperative hemorrhages of varying extent due to infection of the resultant cavity by oral secretions; (2) prolonged discomfort and drainage during the healing phase with need for many repeated packings; (3) a

1 2

Fig. 1. This man has a typical postoperative deformity of the cheek following resection of the right maxilla before immediate skin grafting was employed. The contracture of the healing surface has increased the deformity of the globe and eyelid.

Fig. 2. Another patient in whom more satisfactory positioning of the globe has been accomplished but the contracture inside the cheek has drawn the right corner of the mouth up into a more or less permanent smile.

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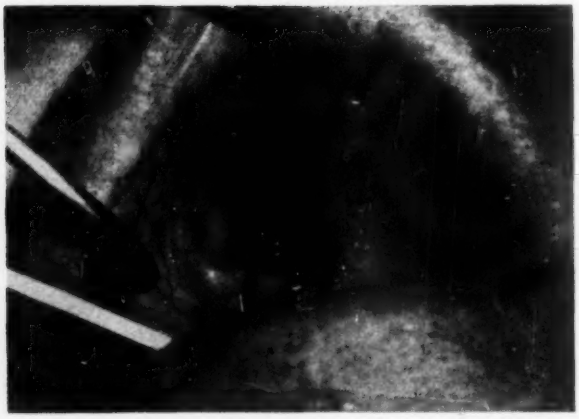

FIG. 3. Postoperative intra-oral view of patient in Figure 2 showing remaining half of palate, opening into sphenoid sinus, and epithelized but contracted surface of right cheek.

FIG. 4.* The much described Fergusson incision; we have found it advisable to carry the knife around the ala nasi in the very depth of the sulcus and to make the transverse incision from the inner canthus as short as possible. Often this limb of the incision is not needed. (Figs. 12 to 15.)

constant flat deformity (Figs. 1 to 3) of the cheek on the resected side, marked edema of the lower lid and a dropping of the globe, often causing diplopia.

Immediate skin grafting to replace the lining of the antrum and the use of an improved "hollow ball" type of oral prosthesis have succeeded in eliminating the aforementioned objections. We are currently using the following technic:

* Figures 4 to 7 reprinted through courtesy of Williams & Wilkins Co. WARD, G. E. and HENDRICK, J. Tumors of the Head and Neck. Baltimore, 1950.

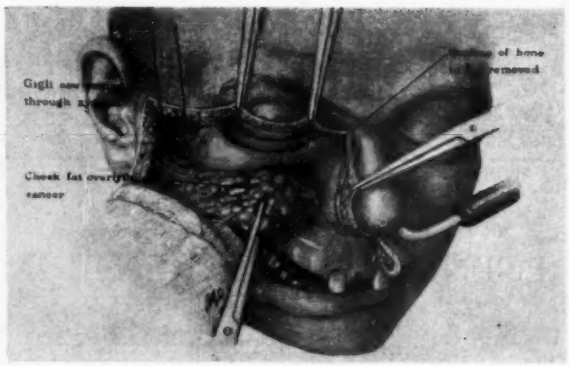

FIG. 5. The cheek flap is turned outward. If there is fear of perforation of the anterior wall of the antrum by tumor, the buccal fat is left attached to underlying bone. Nasotracheal cannula can be seen.

Anesthesia. The patient is usually carried on orotracheal intubation with pentothal,® curare, nitrous oxide and oxygen. The total amount of pentothal® used is quite small. A pillow is placed under the shoulders and a mild Trendelenburg position is used to prevent blood from entering the lungs or stomach. A soft gauze pack is placed in the posterior pharynx. An infusion of glucose is started in one of the ankle veins. We then routinely ligate and divide the external carotid artery at the outset of this procedure. This is a big factor in reducing operative blood loss and postoperative hemorrhage. The artery is divided just above the lingual branch on the side of the proposed resection.

Incision. The old standard Fergusson incision (Fig. 4) may be used, but we have found that this often leads to chronic postoperative lymphedema of the lower eyelid. It is readily possible to expose and remove the entire malar bone, antrum and even pterygoid plates without the transverse extension. We then start the incision at the inner canthus and come downward around the ala to split the upper lip. The extension back along the zygoma is reserved for growths extending into the region of temporal muscle and pterygoid fossa. The incision is deepened with a sharp knife and bleeders are secured with fine white silk ties. The cautery is avoided here because of the proximity to skin surface. The cheek skin is elevated in a plane such as to leave the periosteum attached to the underlying bone unless the operator is certain that the tumor has not penetrated the anterior wall of the antrum. The mucous membrane is divided along the gingivolabial sulcus all the way back to well behind the last molar tooth.

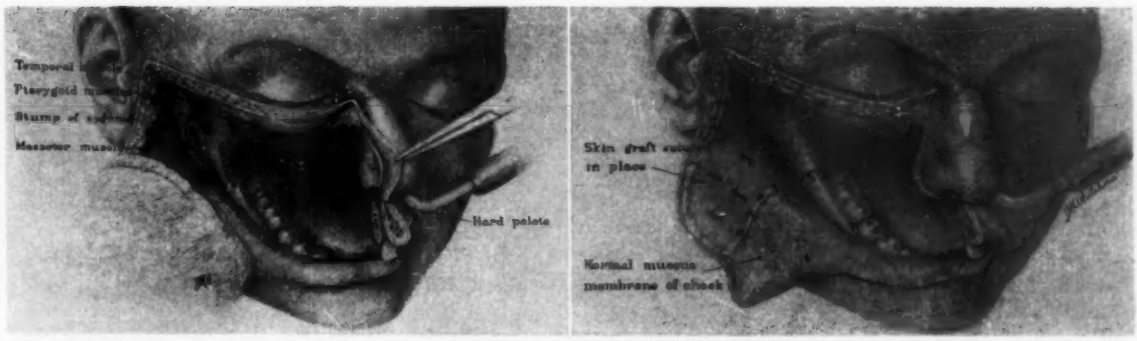

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FIG. 6. The specimen has just been removed including half of the hard palate and the floor of the orbit. The pterygoid muscles and plates can be easily removed if the tumor extends in that direction.
FIG. 7. A split thickness skin graft has been taken with the Blair knife or dermatome and is applied so as to cover all raw and bleeding surfaces. It is allowed to fold into creases and thus reduce further later contracture. It is important to extend the graft under the floor of the orbit to prevent later herniation of orbital fat and resultant enophthalmus.

The cheek fat may be left against the tumor to increase the margin of safety in anteriorly placed tumors. (Fig. 5.) By this time the operator's first assistant will usually have taken a thick split graft from one thigh with the aid of a Blair knife or a dermatome. The graft should be approximately 5 by 4 inches. The donor site is carefully dressed immediately to avoid subsequent contamination with oral secretions. The graft is wrapped in a moist saline sponge until needed.

Division of Bone. As shown in Figure 5 the bone may be divided with the aid of a Gigli saw about the arms of the zygoma and with the aid of thin osteotomes in the case of the flat bones around the orbit and nose. If care is taken not to damage the underlying mucosa, this portion of the procedure need not be very bloody. With growths lying down near the alveolar ridge it is advisable to leave a thin (3–4 mm.) rim of the infraorbital ridge. This will insure normal position and motion of the globe postoperatively. At this point the mucosa of the alveolar ridge and hard palate are divided with the electrocoagulating current. This cut is carried longitudinally back to the soft palate where it may be carried transversely toward the hamulus if the soft palate is not too close to tumor and may be saved. It may be necessary to extract a central incisor tooth in order to position the last osteotome. This instrument is gently driven back in such a manner as to split the palate just on the tumor side of the midline. The greater palatine artery may require control as the soft parts are divided at the posterior edge of the hard palate.

The removal then requires only separation laterally and posteriorly. This may necessitate division of a portion of the masseter muscle. The pterygoid plates and muscles are readily included in the block by passing a large right-angled, double action bone cutter up behind those structures. As this cut is made, the operator may gently rock the maxilla free from its bed with the aid of a lion-jawed type of forceps. (Fig. 6.) The internal maxillary vessels will require clamping and ligature at this time. Frozen sections may then be made of any suspicious areas of tissue and, if need be, the resection may be extended by removal of the globe, ethmoid or sphenoid cells, zygoma, temporal fossa contents or tonsillar fossa. Electrocoagulation may be used on bleeding points or against bone to extend the limits of resection further. Care should be exercised to avoid a leak of cerebrospinal fluid and chance of postoperative meningitis.

Closure. The skin graft is then placed on the undersurface of the cheek flap and sutured with fine catgut to the remaining cheek mucosa. Care is taken not to extend the graft closer to the free flap edge than 1 cm. The entire pterygoid fossa (Fig. 7) and undersurface of the globe are covered so as to leave no granulating surface except the medial exposed edge of palate bone. In this way most of the tendency to later contracture and reduction in jaw function is eliminated.

The cavity is firmly packed with iodoform gauze moistened with balsam of Peru, and the skin is accurately sutured in layers with fine silk. Care is taken to overcorrect the cheek

8 9

FIG. 8. Patient with very advanced squamous carcinoma of alveolus with involvement of palate, antrum, pterygoid fossa, nasal turbinate and extending to orbital floor.
FIG. 9. Twelve days following extensive resection of maxilla and all grossly involved neighboring regions; there is only one small granulating spot in posterior portion of cavity. Patient stated immediate relief of pain, and appetite was much improved following removal of foul and bleeding tumor.

10 11

FIGS. 10 and 11. Show patient three weeks after operation with temporary dental plate to permit good speech and prevent regurgitation when eating; the temporal muscle was used here to support the globe (McFee). There was no postoperative diplopia.

somewhat and distend it with an apparently excessive amount of packing. A large pressure dressing is applied over eye and cheek.

Postoperative Care. These patients should be kept face down until fully conscious in order to keep fluid out of the tracheal tree. After twenty-four hours they are allowed to have clear liquids and rarely require more than 64 mg. of codeine for pain. Many will spontaneously express gratitude for relief of preoperative pain occasioned by bone and nerve involvement.

The skin sutures are removed in seventy-two hours and the oral pack on the ninth day. The new extension to the oral cavity will be found lined with a pink surface of graft epithelium.

The dental service will have constructed a temporary prosthesis which is inserted and used to hold a light pack in the region. After two weeks a permanent prosthesis may be applied. Dr. James Pyott of our prosthetic department had developed a new "hollow ball," light acrylic extension that is molded to fit the new cavity exactly. This may even be extended up to give support to the globe and always will help fill out the bony base to the resected cheek. This is attached to the remaining teeth in the upper jaw. We have had patients with normal speech and no regurgitation after such a prosthesis. The use of an immediate skin

FIG. 12. Shows good contour of cheek and lip following resection of entire upper jaw for chondrosarcoma; there is a very slight depression of left cheek which was readily correctible with a small dermal graft.

graft is an essential to obtaining the best result with such a prosthesis. (Figs. 8 to 15.)

The surgical prognosis varies tremendously with the exact histology and extent of tumor in the upper jaw. However, it should be stressed that operative mortality is now below 1 per cent and that convalescence is both rapid and

FIG. 15. Shows the modern "hollow ball" type of light acrylic prosthesis that this patient wears; this prosthesis was made by Dr. James E. Pyott of our prosthetic department.

comfortable. Hospital stay averages less than two weeks. The procedure has been of considerable value even when used strictly in a palliative sense to relieve pain, hemorrhage and odor.

SUMMARY

Resection of the upper jaw and related structures need no longer carry a high operative mortality. Remaining objections to this procedure center about deformity and discomfort postoperatively. Immediate plastic repair and grafting of the defect left by removal of the antrum will greatly reduce the deformity and discomfort. The use of a modern "hollow-ball"

13 14

FIGS. 13 and 14. Show the type of result that one can expect using the most recent technic as described in this paper; although the tumor involved the pterygoid plates and fossa in this patient and these structures were easily removed, it was not necessary to use the formerly popular transverse extension.

type of acrylic prosthesis will further complement this result and improve speech to a highly satisfactory degree.

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A recent follow-up survey of 100 patients treated for arterial hypertension by sympathectomy—all of whom were considered suitable cases for surgery—confirms my personal suspicions that the eventual results are not as good as we have been told to expect. Only 8 per cent had a return to normal blood pressure readings and 13 per cent were definitely improved, but all the remainder were unimproved or were dead (27 per cent). Apparently nature gradually compensates for the cut sympathetic fibers because the results of sympathectomy frequently become progressively less favorable every month after the operation. However, a statistical study of only a series of 100 cases from one source is really insufficient to justify us to make definite generalizations. We must realize, perhaps, that many cases in this series of 100 were improperly selected and were actually *not* suitable for surgery; whereas, in other instances even though there were proper indications, perhaps an incomplete operation accounts for the unsatisfactory results. I have personally believed for a long time, however, that the ultimate results of surgical sympathectomy will often prove disappointing and that frequently the operation should not be done at all. Surely, its status in the therapy of hypertension is still *sub-judice*. (*Richard A. Leonardo, M.D.*)

Practical Surgical Suggestions

TOURNIQUET FOR INTRAVENOUS THERAPY FOR PATIENTS IN SHOCK

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AS it is frequently quite difficult to administer intravenous medication to patients in shock, any means to facilitate this would prove quite valuable. The primary purpose of the tourniquets proposed herein is for such use.

This method of facilitating intravenous medication requires two tourniquets. One, a simple elastic tourniquet, is placed above the elbow in the usual manner, preferably with the arm lowered below the level of the body; another tourniquet, capable of being rolled, is placed on the wrist and the arm is then raised above the level of the body if possible. The rolling tourniquet is then rolled toward the elbow until the veins distend or to within 1 inch of the antecubital fossa. (Figs. 2, 3 and 4.) This latter tourniquet collects the blood into the small space between the two tourniquets, thereby distending the collapsed veins in this area. A review of the literature of the last ten years failed to reveal any method similar to this to facilitate entry into the vein.

The rolling tourniquet is composed of a heavy round elastic about 8 or 10 mm. in diameter, thereby making it easy to roll. The inner diameter of the tourniquet is about 5½ to 6 cm. in the largest size (Fig. 1), each successive smaller size being approximately ½ cm. less in diameter. Three or four different sizes are sufficient to fit practically any patient's arm.

This tourniquet has been tried on patients in severe shock and has been found

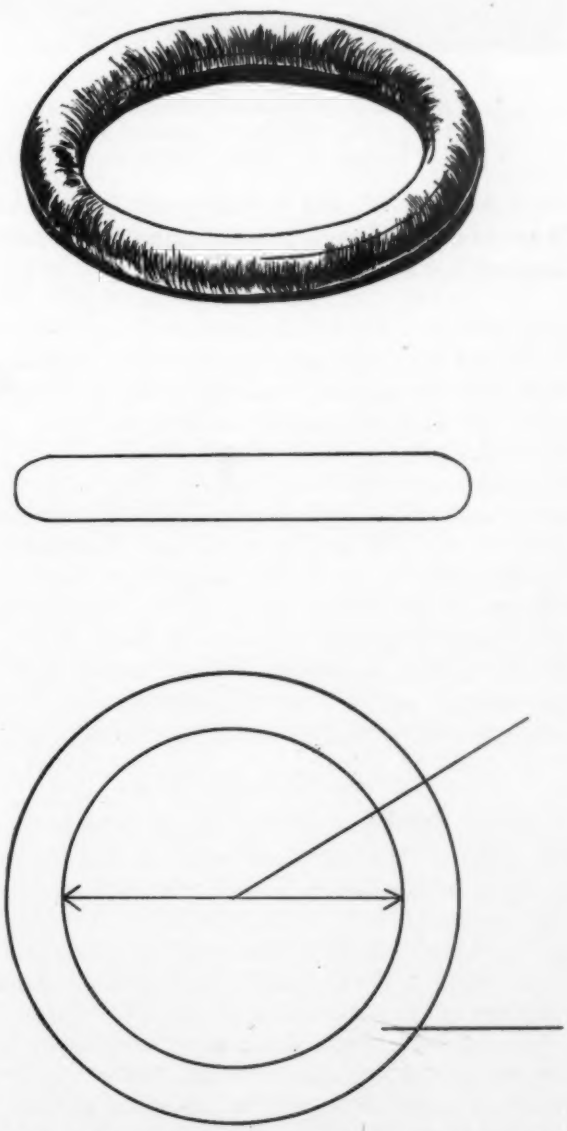

FIG. 1. Largest size is 6 cm.; each successive smaller size is ½ cm. less in diameter.

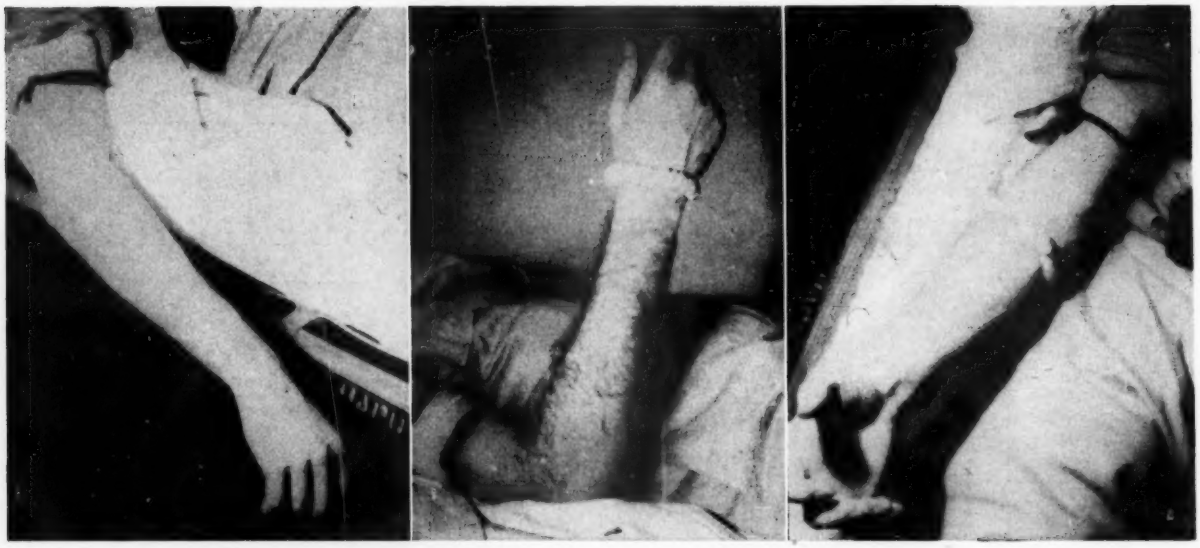

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FIG. 2. Ordinary tourniquet applied above elbow, preferably with arm below level of the body.
FIG. 3. "Rolling tourniquet" applied with wrist elevated above level of the body.
FIG. 4. "Rolling tourniquet" applied to within a few cm. of stationary tourniquet, distending veins.

very successful. Its primary use would be whenever emergency treatment is administered but it is well to note here that it has also been found helpful on numerous occasions on patients whose veins are difficult to enter under normal conditions.

INTRAGASTRIC TAMPONADE FOR INTRACTABLE ESOPHAGEAL, GASTRIC OR DUODENAL BLEEDING*

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Milwaukee, Wisconsin

WHILE working on the neurovascular mechanism of the stomach it was discovered that the blood vessels of the stomach emanate from two large arcuates and then enter the large vascular highway between the muscular and mucus layers of the stomach. The vessels perforate the muscular layer much as the ureter enters the urinary bladder and then branches return to the muscular layer and also extend to the mucous membrane. It was noticed that the inner gastric sleeve of the mucous membrane could be moved back and forth like an arm in a coat sleeve. With this in mind it was believed that the mucous membrane could be moved forward by means of a balloon so as to plug the ulcer crater and thereby arrest bleeding from an eroded blood vessel.

Boas[1] found that profuse hemorrhage from the gastrointestinal tract is a frequent symptom of duodenal ulcers. In severe cases symptoms of collapse follow the escape of blood by mouth or rectum. When very copious the hemorrhage may be the immediate cause of death.

The rule has always been, treat the ulcer patient medically and institute surgical intervention for the complications. The most dramatic and most awesome complication is active gastric or duodenal hemorrhage. The rupture of a large blood vessel supplying an intraperitoneal or intrathoracic organ may prove catastrophic if immediate remedial therapy is not instituted. Wangensteen[2] stated that such an accident is usually fatal and rarely susceptible to treatment. Erosion of a large vessel is attended by sudden hemorrhage and a large vomitus of blood. The usually described "coffeeground" explosive disgorgement follows the type of bleeding that has been insidious in its onset and the shed blood exposed to the digestive juices long enough to be altered. DeLee's routine of expectant treatment has been more religiously applied to actively bleeding gastric and duodenal ulcers than to obstetrics. The average patient with a bleeding ulcer arrives at the hospital after a massive hemorrhage. His condition is poor and blood transfusions are given immediately. This procedure is repeated again and again with the hope that the bleeding will stop. On the other hand, if he continues to bleed, he is again transfused. Then the question uppermost in the mind of the surgeon is, When will the patient be a good surgical risk?

The ulcers which bleed are as a rule posterior wall ulcers.[3] This type of ulcer because of its chronicity has become excessively vascularized, and usually the bed of the ulcer has had the pancreas vulcanized to it so that the bleeding actually comes from an eroded pancreatic vessel. The bleeding is arterial in origin.

Previous work on the blood vessels of the stomach demonstrated the fact that the blood vessels of the stomach emanate from two large arcuates located on the greater and lesser curvatures. These vessels perforate the muscular layer tangentially much as the ureter enters the urinary bladder and are therefore readily compressed. It was believed that the soft yielding mucous membrane[4] could be pressed against the muscular layer, thereby compressing the vessels much as arterial bleeding is stopped by compressing the soft superficial tissue against the frontal bone. To do this an intragastric tamponade in the form of a balloon was devised.

MATERIAL AND METHODS

A double lumen balloon was made and fixed to a double lumen tube.[5] The inner balloon was tied to the tube over a metal sleeve so as to compress one and leave the other lumen patent. The distal end was tied firmly to the end of the tube so as to occlude the end of the balloon and the tube. Within this balloon 5 cc. of mercury were instilled to facilitate placing the tube anywhere within the stomach or duodenum depending upon the location of the bleeding ulcer. This balloon was made airtight so as to gen-

* From the Department of Anatomy, Marquette University School of Medicine, Milwaukee, Wisc.

FIG. 1. Laparotomy wound with the duodenum opened and held apart to show the active, arterial bleeding; bleeding is caused by cutting arteries in the pyloric region of the stomach.

erate intragastric pressure. The outer elastic sheath was tied to the tube higher up and numerous perforations were made in it for the flooding of drugs along the gastrointestinal mucous membrane in the treatment of bleeding ulcers. The drug used to aid clotting was thrombin topical.* The animals used in the laboratory were all large dogs, well nourished and plethoric. The patients selected for this type of treatment (after it was established in the laboratory that bleeding could be controlled by this method) were those who had been repeatedly transfused but continued to bleed and were therefore poor surgical risks.

In patients without nasal obstruction the tube was passed through the nares; but if any difficulty was anticipated or met, the intragastric tamponade was given the patient to swallow while drinking water through a glass siphon. When possible the tube was passed under direct vision by means of fluoroscopy. The tube in place, the inner balloon was inflated by means of a blood pressure bulb. The amount of air introduced varied with the size of the stomach. When inflation was complete, the thrombin topical was introduced through the lumen of the tube communicating with the

* Supplied by Parke, Davis & Co., Detroit, Mich.

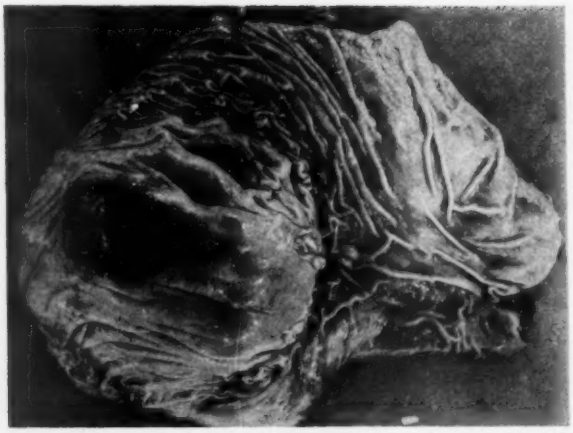

FIG. 2. Stomach opened exposing the surgically created ulcers; the active bleeding was stopped by means of thrombin topical and an intragastric tamponade. Note the absence of blood, both liquid or clotted, except at the margins of the ulcers.

perforated sac. The entire assembly was left *in situ* for one-half hour. This time interval was usually long enough to arrest the bleeding in the average case.

Laboratory Procedure. The animal was anesthetized with nembutal® (1 gr. per 5 pounds of weight) and a midline laparotomy incision was made. The stomach was delivered and about 2 inches from the pyloric sphincter a longitudinal wound was made in the duodenum. Through this ostium a pair of large curved scissors was inserted into the stomach. Under the guidance of the tips of the fingers of the left hand the operator macerated the mucous membrane in the pyloric region of the stomach until very active bleeding appeared through the duodenal opening. (Fig. 1.) The bleeding was not going to stop without intervention. The balloon which had been passed through an esophagostomy was inflated and the contents of one vial of thrombin topical dissolved in distilled water was introduced through the side of the tube communicating with the perforated balloon. The inflated balloon was left in place for one-half hour and after this time lapse was deflated. All animals were autopsied at completion of the experiment and the stomach were examined for the size of the ulcer, the amount of fluid and clotted blood and, when possible, the size of the cut vessel. Figure 2 shows such a stomach. The stomach in this case was devoid of blood and the ulcer was about the size of a twenty-five cent piece. Figure 3 shows the balloon inflated in the stomach of a dog. While the balloon was inflated in the stomach of the

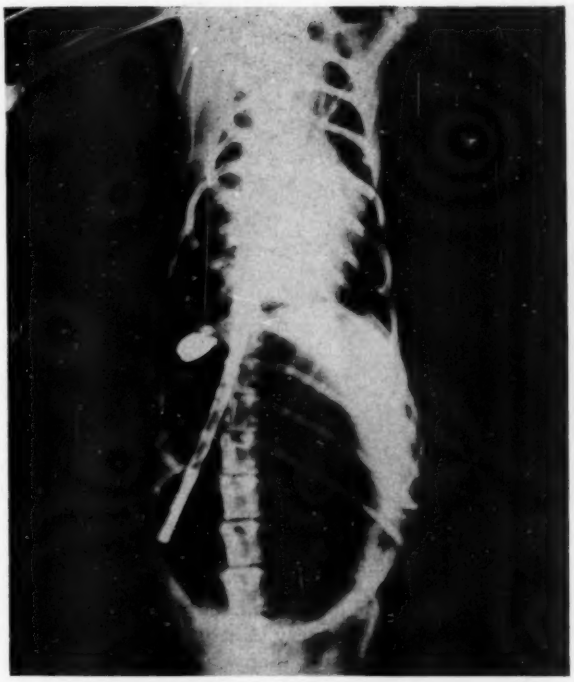

FIG. 3. X-ray of a dog with intragastric tamponade in place and inflated; although the balloon was distended much more than would be required physiologically, no untoward reactions were noted.

dog, the carotid artery was cannulated and blood pressure readings were taken. The kymographic tracing (Fig. 4) shows the reflected respirations as recorded by the writing lever connected with the distended rubber sac within the stomach. The time in seconds as well as the zero blood pressure are also shown.

Clinical Method. The patients selected were those repeatedly transfused but still hemorrhaging who therefore had a poor prognosis. They were not considered good surgical risks because of the continued bleeding. Nine patients in all were treated with this method. The bleeding was arrested in all but one case and in this one a satisfactory maneuver was evolved. The assembly, consisting of the two balloons and tube was passed through the nose when possible. In cases in which the oral route was resorted to the patient was assisted in swallowing the balloon by giving him sips of water through a glass siphon. In Figure 5 the balloon is shown in position in the stomach of a patient and for the purpose of visualization small amounts of barium were given. This method of x-ray study of the gastrointestinal tract will be discussed in another paper. The balloon is shown *in situ* in the stomach in Figure 6.

FIG. 4. Shows the constancy of the blood pressure as taken by directly cannulating the carotid artery although the gastric balloon was greatly distended; the kymogram also shows the respirations as reflected on the intragastric balloon.

CASE REPORTS

The following four cases epitomize the results obtained in the entire series upon which this report is based. The cases in this series were either submitted to surgery or died and a postmortem examination was performed.

CASE I. The patient, a white male adult aged thirty-six, entered the hospital actively bleeding. Five years before he had had a thoracolumbar sympathectomy for malignant hypertension. His blood pressure following surgery remained at 190/120 mm. of mercury. A diagnosis of postsympathectomy gastric ulceration was made and the patient was transfused eight times with citrated blood. Besides blood he was given numerous infusions of plasma. He continued to bleed from the stomach and the intragastric tamponade with unbuffered thrombin topical was used. The bleeding was arrested.

CASE II. This patient arrived at the hospital after having fainted in the bathroom following a copious vomitus of blood. He was repeatedly transfused but the bleeding persisted. The balloons were passed and the thrombin topical introduced. The distended balloons remained in place for one hour after which time the assembly was removed. During this time interval the patient was transfused and prepared for surgery. At operation a large prepyloric ulcer was found on the posterior wall and a subtotal gastric resection was done. His postoperative course was uneventful and he left the hospital on his tenth postoperative day.

CASE III. A diagnosis of ruptured esophageal varix associated with cirrhosis of the liver was made in this case. The patient was in

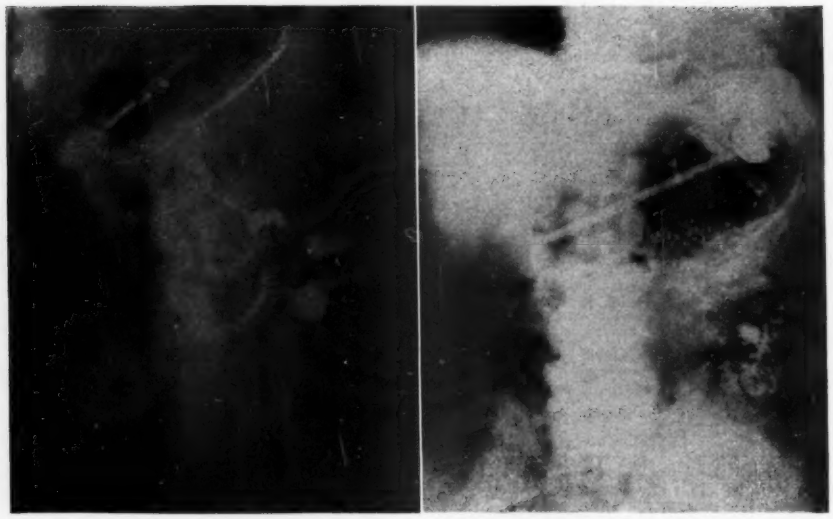

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FIG. 5. Shows the intragastric tamponade within the stomach of a patient; some barium was flooded into the outer balloon for better contrast. The tip of the balloon is firmly impacted against the pyloric sphincter. The barium contrast material with the balloon method shows the gastric mucosa very clearly.
FIG. 6. Shows the balloon within a stomach of greater capacity than that shown in Figure 5; a portion of the balloon has entered the duodenum. This position is necessary to control bleeding from a duodenal ulcer.

shock. He was transfused repeatedly but the bleeding continued unabated. The balloons were passed so that two-thirds were in the stomach and the remainder was in the esophagus. The balloons were distended and the vomiting of blood stopped. Thrombin topical was introduced and after thirty-five minutes the balloons were removed. There was no bleeding. The patient was discharged from the hospital without surgical intervention.

CASE IV. This patient, a white male aged seventy-two, entered the hospital because of gastric bleeding. A diagnosis of prepyloric ulcer was made. He was transfused repeatedly. After ten transfusions a laparotomy was done with the intention of doing a subtotal gastric resection. At operation no ulcer was found and the diagnosis was changed to ruptured esophageal varix. The abdomen was closed and he was again transfused with 500 cc. of citrated blood. The patient was returned to his room in poor condition. The vomiting of blood continued. The balloons were passed and left in place all night. Thrombin topical was introduced on numerous occasions. In the morning the balloons were removed. The patient had stopped bleeding.

COMMENTS

The information gained in our studies on the neurovascular mechanism of the stomach and the great need for more positive efforts in the treatment of acute gastrointestinal bleeding led us to devise the intragastric tamponade. To arrest active bleeding from an esophageal varix, gastric ulcer or duodenal ulcer, we created intraluminal pressure by means of a double balloon and at the same time planted a blood-clotting substance in the area of the ulcer.

To maintain a good clot in the bleeding area, thrombin topical was introduced through the side of the tube communicating with the perforated balloon. It was noted that during active gastric or duodenal bleeding the contents were neutral and therefore it was not necessary to buffer the gastric contents before the introduction of the thrombin topical. If there was a goodly amount of blood in the stomach, the action of the thrombin topical on the blood was greatly enhanced and a larger, firmer clot was the result. The distended balloon caused no apparent difficulty. The pulse remained regular. No extrasystoles were noticed, nor did the patient complain of substernal pain. Blood pressure tracings on dogs with balloons in the stomach showed no abnormal variations. In cases in which the bleeding recurred after the intragastric temponade was released, it was found practicable to reinflate the balloon to prevent the escape of more blood. The patient was repeatedly transfused with the balloon in

place until he became a good candidate for surgery. He was then taken to surgery, the abdomen was opened, the lesion located and definitive treatment decided upon. The anesthetist opened the valve connected with the inflated balloon and the air escaped, having all this time prevented further escape of much needed blood. Because of this method the patient survived the surgery indicated.

Van Zwalenburg showed that 30 mm. of mercury pressure within the intestine caused capillary stasis, at 60 mm. there was venous stasis, there was some arterial arrest at 90 mm., and there was complete circulatory arrest at 130 mm. of mercury pressure. Wangensteen found that in dogs an intraluminal pressure of 40 cm. over a period of seventeen to twenty hours caused necrotic areas with abnormally permeable and non-viable bowel. When the balloon was inflated, the blood vessels of the stomach showed a remarkable alteration in activity. The arteries which up to now were pulsating, suddenly became inert and acted much more like the veins. Gatch[8] showed that 200 mm. intraenteric pressure caused a reduction of venous return to 3 cm. per minute. When pressures are exerted to a very limited surface, the stress point is much greater than when a large balloon is used and a uniform force is exerted on all of the vessels supplying the organ.

SUMMARY

Because of the difficulty in handling active gastric or duodenal bleeding ulcers an intragastric tamponade was devised. This balloon technic could also be used to stop the bleeding of esophageal varices. For the bleeding of an esophageal varix the balloon must be arrested in the esophagus. Half of the balloon would be inflated within the esophagus and the remainder would mushroom within the cardiac-fundic area of the stomach. The surgeon can now be certain of operating on a patient whose bleeding has been controlled and who is, therefore, a better surgical risk. The procedure is time-saving. It is a means of keeping the blood donated to the seriously hemorrhaging ulcer patient within the vascular channels. The doctor can now specify the time of surgery. This simple procedure places the surgery of bleeding gastric or duodenal ulcers in the elective instead of the emergency class.

A double lumen tube with an intact inner and a perforated outer balloon, each communicating with a separate lumen, is passed into the stomach. The intubation should be done under fluoroscopy when possible. The tube in place, the intact balloon is inflated under fluoroscopic visualization. Thrombin topical is then introduced. It is not necessary to neutralize the stomach contents of a patient with an active bleeding ulcer. The tube as a rule is left in place for thirty minutes. If the bleeding should recur after the pressure has been released, the balloon should be reinflated. The patient should be given as many transfusions as necessary to return him to the status of a good surgical risk. The tamponade is released during the operation when active intervention has been instituted.

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Case Reports

SUBMUCOUS LIPOMAS OF THE SMALL INTESTINE

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SYMPTOMATIC lipomas of the small bowel are unusual. The report of such cases serves to focus attention on the place of benign tumors in the differential diagnosis of intestinal obstruction (particularly by intussusception), unexplained melena and epigastric distress.

The rarity of benign tumors of the small bowel is attested by several studies. King[7] in 1917 could find reports of only 119 cases of histologically proved benign tumors in the literature, twenty-nine of which were cases of lipoma. Willis in 1920[19] culled only nineteen such benign tumors from 7,492 necropsies at Boston City Hospital and Massachusetts General Hospital, an incidence of 1 per 394 individuals. Kirshbaum[8] of the Cook County Hospital in Chicago found twelve benign tumors in 5,754 necropsies from 1929 to 1934, an incidence of 1 per 480 persons. Half of his were lipomas. In 1931 Comfort[2] reported twenty-four cases of submucous lipoma of the gastro-intestinal tract that were encountered in the course of 3,924 necropsies performed at the Mayo Clinic. Raiford[14] at Johns Hopkins Hospital in Baltimore found fifty benign tumors, or 1 per 930, but to his 11,500 necropsies he added 45,000 surgical specimens; seven of the fifty tumors were lipomas. The incidence of subclinical lipoma of the small intestine found in the study which we report on subsequent pages was 1 per 325 necropsies.

Ewing[4] said that congenital predisposition of the tissue is an essential factor in the origin of most lipomas. He stated that the comparative isolation of the blood supply of the lobules that reappear in lipomas suggests that the anomaly which predisposes to the lesion is connected with the distribution of blood vessels in the fatty tissues. Kölliker and Toldt[10] stated, according to Ewing, that fat lobules have a certain independence in development which constitutes them a sort of primitive organ. No peculiarity in the chemical composition of the fat of lipomas, no deficiency of lipase and no grounds for the assumption that the fat of these tumors is beyond the reach of the fat-mobilizing factors of the body were found by Wells.[18] However, since many lipomas continue to grow while the body is emaciating and not a few remain unaffected during the loss of body fat in tuberculosis (Madelung[12]) or gastritis (Kuster[11]), one must assume that local conditions, possibly the character of the circulation, may prevent absorption of the lipoma.

The relative freedom of the small intestine from stasis of fecal content, except in the terminal portion of the ileum where the fecal material accumulates before passing into the cecum, is considered to be of significance by Raiford since the tumors in his series occurred most frequently in the terminal part of the ileum. Stasis is likewise found in the stomach and large intestine and these sites are also especially susceptible to invasion by a tumor. Stasis is known to be conducive to irritation; and if one accepts the irritation theory of the cause of cancer, stasis must, Raiford has said, be accepted as a contributing factor. He has further pointed out that since the small intestine develops chiefly during the latter four months of fetal life, it is plausible to assume that there is far less opportunity for arrested development and the misplacement of embryonic tissue to occur in the small intestine than in the remainder of the gastro-intestinal tract.

It is striking that Mayo and Griess[13] for a period ending December 31, 1947, found almost three times as many surgically significant submucous lipomas of the large intestine

(twenty-five cases) as the number of surgical lipomas of the small intestine in our series; this is especially significant when it is considered that the large intestine, although of greater diameter, is only about 5 feet (approximately 1.5 M.) long in contrast to the 23-foot (about 7 M.) small intestine in which only nine surgically significant lipomas were encountered.

The lesions are typical lipomas with large cells that contain peripheral small nuclei with a small amount of dark-staining chromatin. They vary from 1 to 6 cm. in diameter, with the smaller ones generally sessile and the larger ones pedunculated. When a long pedicle is attained, a tumor of this type may be torn loose and extruded through the bowel. The lesions are soft to touch and on cross section are yellow, similar to lipomas from other regions of the body. Ulceration of the mucosa over the lipoma was present in six of the nine symptomatic lesions in our series. Although bleeding as a symptom is infrequent, it occurred in two cases of this series, in one of which there was no ulceration on the surface of the lipoma when it was removed.

MATERIAL

This study covered sixty-seven lipomas of the duodenum, jejunum, ileum and Meckel's diverticulum found in the Mayo Clinic surgical pathology files up through 1948 and in the necropsy files for the years 1922 through 1948. Lesions of the ileocecal valve and cecum were not included. In fifty-three of the sixty-seven cases the lesions were subclinical and were found in the 17,241 necropsies. In the remaining fourteen cases the lesions fall into two main categories: (1) those which caused symptoms and required surgical extirpation; in this category there were nine, one of which was located in Meckel's diverticulum; and (2) those found incidental to procedures for other serious intestinal lesions; these numbered five. Of the lesions seen at operation, four of the nine symptomatic lipomas and all of the five asymptomatic lesions have not been reported previously. Only two of the fifty-three cases found at necropsy have been reported.

Location. The ileum is the most common site for lipomas of the small bowel. In our series the lipoma appeared there in 42 per cent of the cases. One-fourth of the time it was seen in the jejunum, and in nearly one-third of the cases in the duodenum. In two cases (3 per cent) it was actually in a Meckel diverticulum, one case being encountered at necropsy and the other at operation (Case IX). At necropsy in one case multiple lesions were found throughout the small intestine and over the skin.

Symptoms and Signs. It is most unusual to diagnose a symptomatic lipoma of the small intestine preoperatively. Generally it makes itself known by an intussusception, an event that occurred in all but two of the nine cases of symptomatic lesions described in this report; in these two cases the lesion was in the duodenum. When an intussusception occurs in adults, a benign lesion of the small bowel should surely be considered. Eliot and Corscaden,[3] in reviewing the reports of 300 cases of intussusception, found benign lesions of the small bowel to be responsible in one of five cases. Intussusception generally will give rise to the classic signs and symptoms of acute intestinal obstruction, namely, crampy pain, nausea, vomiting, alteration in fecal elimination leading to obstipation, and abdominal distention, plus a palpable abdominal mass in many cases.

In this series emesis occurred in about one-half the cases but hematemesis was not reported. When pain occurred (67 per cent of the nine cases of symptomatic lipoma), it was frequently of the type that is associated with intestinal obstruction. A mass could be palpated in nearly one-half of the nine patients but in only about one-fourth was the abdomen found tender upon manipulation. Bleeding from the rectum was a sign in only two of the nine cases, in both of which bright red blood was noticed as well as tarry stools. This seems quite unusual since in the seven lesions that were not associated with rectal bleeding, ulceration occurred in all but one. In one of the two cases in which bleeding occurred an intact mucosa was found over the lipoma (Case IX).

Marked anemia that required transfusion developed in one case; the erythrocyte count fell to 2,000,000 per cubic millimeter and the hemoglobin to 45 per cent of normal.

It is notable that epigastric distress of varying degrees was seen in six of the nine cases, leading in one instance (Case IX) to the diagnosis elsewhere of duodenal ulcer. One of the patients had a coexistent duodenal ulcer and duodenal lipoma but at the time of operation the ulcer was healed.

Change in bowel habits was noted in five of the nine cases but no definite pattern emerged

from this study, the findings varying from diarrhea to obstipation. Anorexia was not a symptom. Only two patients lost weight; one lost 30 pounds (13.6 kg.) in two years and the other 24 pounds (10.9 kg.) in three months.

Duration of Symptoms. The duration of symptoms before operation averaged three years and three months but ranged from two days to six years. The case in which the duration of symptoms was two days was that in which severe acute intestinal obstruction developed.

Age and Sex. No substantial difference in the age distribution or average age was noted between the group of nine patients who had symptomatic lipomas and the group of five patients who had asymptomatic lipomas. The average age of patients in the former group at the time of operation was fifty-four years and the ages varied from thirty-seven to sixty-nine years. The average age of the patients in the latter group was fifty-two years and the ages ranged from twenty-one to sixty-five years. The lipomas occurred somewhat more frequently in males, two-thirds of the symptomatic lesions being in men.

Laboratory Data. The erythrocyte count ranged from 2,000,000 to 5,000,000 per cubic millimeter of blood and the hemoglobin value from 42 to 98 per cent (based on a normal of 16 gm. per 100 cc.). In six of the nine symptomatic lesions there was ulceration of the mucosa of the lesion but generally this does not seem to have caused marked intestinal bleeding as it was not substantially reflected in the blood picture. The leukocyte count did not vary significantly. In the one case (Case IX) in which complete blood studies of lipids were done no significant variation from the normal was seen.

Mechanism of Obstruction. Obstruction by an intraluminal mass is not frequent in lipoma of the small bowel. The obstruction is generally due to intussusception. In our series of symptomatic cases intussusception occurred in all but the two in which the lipoma was located in the duodenum. Apparently the tumor projects into the lumen of the bowel and is pulled forward by peristalsis, dragging the proximal portion of the bowel with it into the distal portion of the intestine. This is prone to occur in the ileum and jejunum but would not be seen in the duodenum under normal anatomic conditions. A lipoma with a slender pedicle can be torn from its attachment to the bowel and be extruded from the rectum. Rarely the detached lipoma may cause an intraluminal obstruction (as in the case reported by Kirshbaum) as it approaches an anatomically narrowed portion such as the terminal part of the ileum.

An extraluminal lipoma can occur and is detected by the patient only when its mass becomes sufficient to make it palpable or to cause symptoms by encroaching on the bowel lumen.

Roentgenologic Diagnosis. Examination of the small bowel by roentgenoscopy is difficult and time-consuming at best; however, by careful scrutiny of every portion of the duodenum, jejunum and ileum most benign lesions that cause symptoms may be found. Good,[5] Good and MacCarty,[6] and Weber and Kirklin[16] have stated that the majority of neoplasms of the small bowel can be demonstrated.

The roentgenologic study as reported in the records in this series gave negative results in only one case. In two instances (Cases VI and IX) the lesion was diagnosed during roentgenologic examination of the colon. This is particularly heartening for if the possibility of this lesion is kept in mind in the differential diagnosis of abdominal pain, melena and epigastric distress, one will avoid potentially serious errors. In about one-half of the cases of symptomatic lipomas in this series a correct diagnosis could not be made preoperatively. A clinical and roentgenographic diagnosis of duodenal ulcer was made by the family doctor in Case IX. In two cases an operation was performed during the period when the lipoma was causing trouble. In one instance (Case II) the patient was operated upon for diverticulitis of the sigmoid and four years later for cholelithiasis only to have a recurrent intussusception lipoma of the jejunum resected by a transjejunal approach two months later. In another case the patient had had an appendectomy only seven months prior to coming to the clinic.

TREATMENT

Every lipoma of the small intestine that is diagnosed should be removed primarily because of the very serious danger of intussusception. Frequently this may be accomplished by transintestinal excision without resection; however, if intussusception has occurred, it may be necessary to resect a portion of the small bowel followed with end-to-end anastomosis. Lesions in the duodenum are best taken care of by

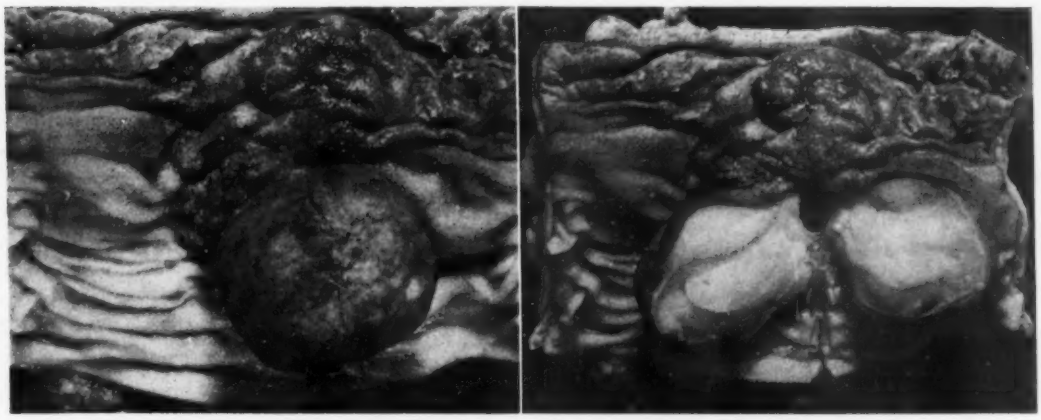

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FIG. 1. Case IV. Pedunculated intussuscepted submucous lipoma; A, before and B, after sectioning of the lipoma.

transduodenal excision; but if the lesion is such that the lumen of the duodenum would be compromised by such a procedure, gastroduodenostomy or even gastrojejunostomy must be done. If complete obstruction of the bowel has resulted from intussusception or, much more rarely, from intraluminal obstruction, prompt attention must be paid to the electrolytes of the blood and to distention of the bowel.

In the following reports Cases I through IX are those in which the lipoma caused symptoms (Group 1) while Cases X through XIV (Group 2) are those in which a lipoma was found incidentally at the time of an abdominal operation for another reason.

CASE REPORTS

CASE I. This case was referred to by Good and MacCarty in 1942. The tumor was diagnosed on roentgenologic examination of the stomach. The lipoma measured 2 by 1.5 by 1.5 cm. and had a small area 3 mm. in diameter of ulceration of the mucosa. The pedicle was ligated and the tumor removed. The anterior one-quarter of the pyloric ring was then excised and the stomach and duodenum were closed transversely as a Judd type of gastroduodenostomy making a large opening between the two organs.

CASE II. This case was reported by Wellbrock in 1931,[17] by Bargen in 1932[1] and again by Rankin and Newell in 1933.[15] The lipoma was in the first part of the jejunum and measured 5.5 by 2.5 by 2.5 cm. It caused intussusception.

CASE III. This case was referred to by Good and MacCarty in 1942. The lipoma was in the ileum just proximal to the ileocecal valve and measured 6 cm. in diameter. It caused intussusception.

CASE IV. A sixty-three year old blacksmith was well until two days before entry into the hospital. At that time he experienced acute, crampy abdominal pain which persisted unchanged until operation. The pain was periumbilical and non-radiating. The patient vomited once four hours after onset and again twelve hours later. He had no hematemesis. His last normal bowel movement occurred eight hours before onset of the abdominal pain. No blood was seen in the stool at any time. He had no fever. For a day and a half before operation he had mild hiccoughs. He gave no history of food dyscrasia, jaundice, loss of weight or previous similar episodes.

On examination no rebound tenderness, spasm or point tenderness could be elicited. The liver and spleen were not palpable. The cecum could be rolled under the fingers. During paroxysms of pain peristaltic high-pitched tinkles were heard. Rectal examination disclosed a normal rectum in which there was a small amount of brown feces but no blood.

On August 8, 1943, the patient was operated on under combined spinal and pentothal sodium® (thiopental sodium) anesthesia. Through a low right rectus incision an ileo-ileocolic intussusception was seen, the apex of which was well into the ascending colon. The intussusception was caused obviously by a firm lipoma, 2.5 cm. in diameter, at a point 30 cm. above the ileocolic valve. A segment of ileum measuring 7 to 8 cm. in length, including the tumor, was excised and the continuity of the

ileum re-established by side-to-side anastomosis. Recovery was uneventful. (Fig. 1.)

CASE V. This was referred to by Good and MacCarty in 1942. The lipoma was in the ileum, 45 cm. above the ileocecal valve, and measured 5 cm. in diameter. It caused intussusception.

CASE VI. This was reported by Knoepp in 1933.[9] The lipoma was in the ileum, 26 cm. above the ileocecal valve, and measured 4 by 3 by 2 cm. It caused intussusception.

CASE VII. A forty-one year old drill inspector had had an appendectomy in November, 1937, by his home-town physician and subsequently had had obstruction of the transverse colon which required lysis of the adhesions by the same doctor in March, 1938. In January, 1945, he complained of weakness, pallor, easy fatigability and black stools for five weeks. The value for hemoglobin at that time was 42 per cent of normal and the erythrocyte count was 2,000,000 per cubic millimeter of blood. On each of three occasions he received 1,000 cc. of blood by transfusion and other supportive treatment was given with improvement marked enough to permit him to return to work.

A huge, dark, loose stool followed in a few hours by another loose stool with bright red blood in March, 1945, brought him to the clinic for examination. At that time his hemoglobin measured 8.1 gm. and his erythrocyte count was 3,630,000. Roentgenologic examination of the small intestine demonstrated an intraluminal polypoid lesion about 1 cm. in diameter and 4 cm. long in the ileum approximately 3 to 4 feet (about 90 to 120 cm.) orad to the ileocecal valve.

After two transfusions of 500 cc. of blood a transcolonic excision of a polyp of the terminal portion of the ileum was carried out, with the patient under combined anesthesia with nitrous oxide, oxygen and ether (intratracheal), through a tertiary low right rectus incision. The lesion was located exactly where described by the roentgenologist, that is, about 3 feet from the ileocolic valve. The pedicle was 2.5 inches (about 6.4 cm.) long and there was some dimpling of the intestinal wall at the site of its attachment indicating that intussusception had taken place. This area was excised with the polyp and the ileum was reconstructed. The postoperative course was uneventful.

CASE VIII. A fifty-five year old male office worker said that for the first time in his life, in July, 1946, he began to have some epigastric pain on the left side three hours after eating. This pain was gnawing and never very sharp. It was relieved by milk or water. He never had had nocturnal pain. In September, 1946, his home-town doctor diagnosed a duodenal ulcer on roentgenologic examination and prescribed an ulcer diet. A roentgenogram in November of the same year showed a healed duodenal ulcer and a duodenal polyp.

On entrance to the clinic in August, 1947, the patient remarked that he rarely had pain then and that when it did occur he could get relief promptly by drinking milk. He complained of no indigestion, belching, postprandial gas, nausea or vomiting. He was never jaundiced. Roentgenograms made at the clinic demonstrated a polypoid lesion about 1 cm. in diameter in the first portion of the duodenum.

The patient went home and returned in December, 1947, for an operation. With the patient under combined anesthesia with nitrous oxide, oxygen and intratracheal ether a primary upper right rectus incision was made and a Judd type of gastroduodenostomy performed. Two-thirds of the pyloric sphincter were excised; the muscle was hypertrophied. On the posterior wall near the superior border of the duodenum was a small puckered area which may have represented a small duodenal ulcer. The lesion seen on the roentgenogram was found to be a pedunculated submucous lipoma measuring 1 cm. in diameter. The patient made an uneventful recovery.

CASE IX. A thirty-nine year old bank clerk, four years before coming to the clinic, noticed a sharp pain across the lower part of the abdomen when he lifted a lawn mower. This pain gradually eased and was not severe enough to keep him from working. Subsequently he had periodic bouts of pain in the right lower quadrant that lasted several hours; occasionally the pain covered the entire abdomen. A year and a half prior to coming to the clinic he had some bright red blood in the stool which he described as "not in the fecal material but coloring the water in the bowl considerably." One month later he had a tarry black stool and one week before admission he had a small amount of bright red blood on the feces. He vomited but once, three months before coming to the clinic.

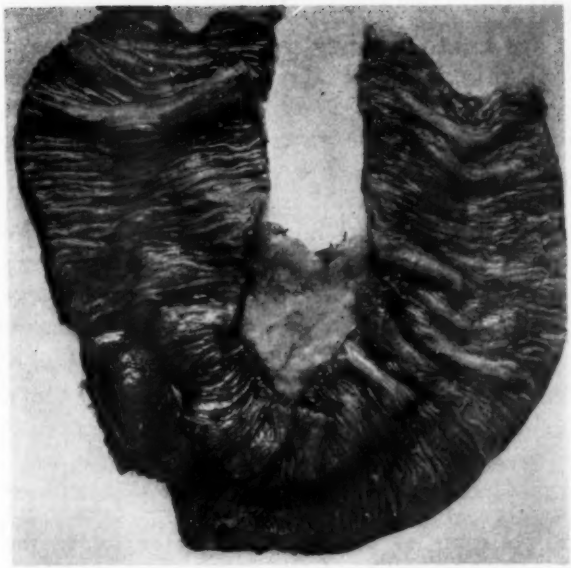

FIG. 2. Case IX. Lipoma situated near the tip of a Meckel diverticulum which had invaginated into the bowel and produced a mucosa-covered polyp-like mass with an area of gastric mucosa near the apex.

The pain in the right lower quadrant often awakened him at night and he began taking a milk diet and a preparation of aluminum hydroxide eight weeks prior to reporting. His pain was worse after meals but was relieved temporarily by the milk and the alkali. It had been worse in the fall and relieved in the summer. He complained of excessive flatus, belching and borborygmi. Occasionally he had a gnawing sensation in the epigastrium.

The home-town physician had made a diagnosis of duodenal ulcer in June, 1945, on the basis of a roentgenologic examination. The patient stated that the ileum was called "normal" at that time. In August, 1945, a follow-up roentgenogram demonstrated that the ulcer was still there. The patient had lost 24 pounds (10.9 kg.) in the three months prior to arrival at the clinic in December, 1946.

Abdominal examination at the clinic revealed only a rather firm loop of bowel in the cecal region. Roentgenologic study of the colon disclosed a lesion of the lower or mid-portion of the ileum that was causing ileo-ileal intussusception. The roentgenologist stated that the lesion was probably a neoplasm but that Meckel's diverticulum should be considered.

With the patient under combined anesthesia with nitrous oxide, oxygen and intratracheal ether the abdomen was explored on December 13, 1946, through a primary right rectus incision. A firm mass of small bowel was found about 4 or 5 feet (about 120 to 150 cm.) from the ileocecal juncture. There were enlarged nodes in the mesentery, and a wide segment of mesentery and bowel containing the lesion was removed. The entire small bowel was dilated and the walls hypertrophied as a result of the recurrent obstruction from intussusception. The stomach, duodenum, liver, pancreas and spleen were normal. A chronically diseased appendix was removed. The bowel was closed by end-to-end anastomosis.

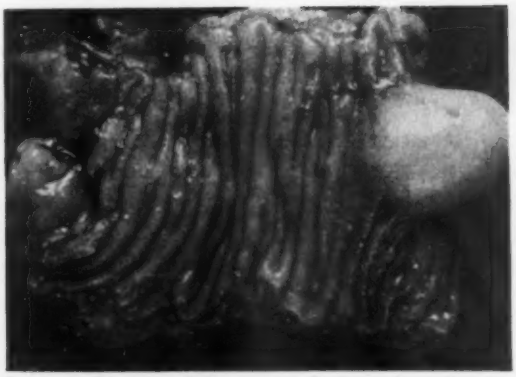

FIG. 3. Case X. Submucous lipoma found coincidentally in the ileum during operation for removal of a recurrent adenocarcinoma of the sigmoid.

Two days postoperatively the values for cholesterol, cholesterol esters, amylase, fatty acids and total lipoids were within normal ranges. The patient made an uneventful recovery and in a follow-up letter in December, 1948, wrote that "the operation was 100 per cent successful."

The lesion was reported to be a submucosal lipoma that measured 2 by 1.5 by 1 cm. and that was situated near the tip of a Meckel diverticulum, which had invaginated into the bowel and produced a mucosa-covered polyp-like mass that measured 5 by 4 by 3 cm., with an area of gastric mucosa near the apex. (Fig. 2.)

CASE X. A sixty-five year old woman was operated upon in 1946 for a recurrent adenocarcinoma of the sigmoid and an ileosigmoidal fistula. A lipoma was found in the ileum at the site of the fistula; the tumor measured 2 by 1.5 by 1 cm. (Fig. 3.)

CASE XI. A fifty-eight year old man was operated upon in 1943 for adenocarcinoma of the cecum with nodal and peritoneal involve-

ment. A lipoma measuring 3 cm. in diameter was found in the ileum 10 cm. above the ileocecal valve.

CASE XII. A sixty-two year old man in 1928 had a gastroenterostomy because of a duodenal ulcer, and an appendectomy. A lipoma the size of a "small English walnut" was observed on the jejunal wall opposite the gastroenteric stoma. It was deemed to be of no surgical significance and was not removed.

CASE XIII. A thirty-four year old woman was operated upon in 1935 for adenocarcinoma of the colon and chronic ulcerative colitis. A lipoma was found 8 cm. above the ileocecal valve and was included in the operative specimen.

CASE XIV. A sixty-four year old man was operated upon for adenocarcinoma of the ascending colon in 1943, and a lipoma (5 by 2 by 2 cm.) of the terminal part of the ileum at the ileocecal valve was found and included in the operative specimen. The pathologist reported two more lipomas after examination of the tissue. One of these was in the cecum and measured 3 mm. in diameter; the other was in the ascending colon and measured 8 mm.

SUMMARY AND CONCLUSIONS

Records of sixty-seven cases of lipoma of the small bowel are available in the Mayo Clinic files. In fifty-three of the cases the lipoma was subclinical and was discovered at necropsy, in nine it was symptomatic and required definitive operation and in five it was found during operation for other gastrointestinal lesions.

Lipoma of the small intestine occurred once per 325 necropsies. It appears that surgically significant lipoma is nearly three times as common in the large intestine as in the small intestine although that structure is but one-fifth the length of the small intestine.

Intussusception was the event that generally led to the diagnosis of lipoma in the nine cases in which the tumor caused symptoms. Pain, epigastric distress, palpable abdominal mass, emesis and change in bowel habit were the most frequent symptoms. Bleeding from the rectum occurred in only about one-fourth of these nine cases although two-thirds of the lesions showed ulceration of the mucosa covering them. The duration of symptoms averaged three years and three months but ranged from two days to six years.

The average age of individuals with symptomatic tumors was fifty-four years and the range in age was from thirty-seven to sixty-nine years. Two-thirds of the symptomatic lipomas occurred in males. Most of the lesions were found by roentgenographic and roentgenoscopic examination.

When a diagnosis has been made, the lesion should be removed immediately, whether the patient has symptoms or not, because of the potential hazards of erosion and intussusception. Furthermore, the benignity of the lesion cannot be determined from the roentgenologic examination or history.

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EPIDERMAL FISTULA OF THE PERINEUM*

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BECAUSE of its anatomic peculiarities and the abundant bacterial flora in its immediate vicinity, the anal region constitutes one of the most common sites for suppuration. In addition to abscesses which have their origin within the anus, there are those which arise from congenital abnormalities and those that begin in cutaneous elements. With the exception of the common pustular lesions of the skin, all perianal infections, deep or superficial, may be expected to eventuate in a chronic or recurrent draining opening. In this respect fistulas that have a portal of entry within the anus predominate. Draining sequestration sinuses in the coccygeal region are almost as numerous. Congenital perineal sinuses are only occasionally seen. Probably the rarest of all persistent suppurating skin lesions are those believed to be associated with the apocrine sweat glands, namely, hidradenitis suppurativa and acne conglobata which are perhaps confluent and discreet manifestations of the same disease.[1]

Small caliber channels lined by squamous epithelium and communicating with anal crypts have been described by Gordon-Watson and Dodd.[2] Gabriel[3] also gives several examples of sinuses arising from the ectodermal part of the anal canal, all lined with squamous epithelium.

Short skin-lined sinuses not associated with the anal canal occur more frequently than is generally supposed. About these N. D. Smith[4] has stated, "Pseudosinuses are lesions which are apparently congenital in origin and usually of little significance, but knowledge of their occurrence will tend to prevent the tendency to complicate a rather simple problem. Usually these lesions cause very little discomfort but, owing to the collection of desquamated epithelium and the presence of hair, fecal concretions and moisture, infection may occur. They can be corrected readily by surgical excision." Further, the same author[5] notes, "A rather unusual type of pseudosinus is that caused by very large hair follicles which may contain several hairs and may be 0.2 to 0.5 cm. in diameter. In the presence of infection these too may lead to confusion in making a diagnosis, but usually such follicles are multiple and the presence of several follicles not involved by the infection will suggest the correct diagnosis. Surgical excision usually will provide a satisfactory result."

Epidermoid lesions occurring on gluteal, perineal and perianal skin, akin to that already described by Smith, appear to arise independent of congenital sequestration and do not communicate with the anus. In these cases a point of suppuration not unlike a common furuncle makes its appearance in connection with a minute epithelium-lined tract whose opening may be some distance away and not related to the midline. Their clinical significance lies in their ability to masquerade as any of the other common pus-discharging lesions and in their proneness to produce recurrent abscess. Recent reference has been made to such lesions by Anderson,[6] who has applied to them the term "epidermal fistulas." He believes, "The process either originates in the double comedos of a severe acne vulgaris or follows a process akin to hidradenitis suppurativa." In his clinical description he states, "On close examination one finds two distinct openings, from one or both of which a purulent or fatty material may be expressed. Careful probing will demonstrate that these two openings are connected with each other by an epithelium-lined fistulous tract."

Diagnosis of these small lesions is dependent upon the recognition of a minute opening which admits a probe of 1 mm. caliber adjacent to a "boil" or small abscess. In this respect the lesion is similar to a pilonidal sinus, but it does not as a rule contain skin appendages.

In some cases the location of the abscess or discharging opening has led to the belief that a common anal fistula is present, but the search for an internal opening is unproductive.

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FIG. 1. Case II, to the right of the anus is a broad scar, the result of operation performed elsewhere and of an excision of epidermal fistula; the salivary probe entered a tract extending almost to the median raphe where a second opening exists.

FIG. 2. Case II, photomicrographs showing acute inflammation surrounding fistulous tract.

These small lesions are not very frequently encountered. Three of the cases reported herein have been seen during the past two years of private practice. Others have been demonstrated among inductees and army personnel.

CASE REPORTS

CASE I. H. L. H. was a fifty year old white male who for three weeks had had a gradually increasing, painful swelling near the anus. After two weeks of treatment with sitz baths an abscess opened spontaneously which discharged a small amount of pus. Symptoms subsided for a few days but pain and swelling recurred two days prior to consultation on April 16, 1946. The diagnosis by the referring physician was "probable anal fistula." Examination showed a small, depressed, granulating opening 4 cm. from the anus in the left anterior quadrant and a second minute opening in the skin 2 cm. towards the anterior raphe. A communication between them could be easily demonstrated by means of a salivary probe. Hot sitz baths were prescribed, and the patient was advised to have the lesion excised after the inflammatory process had subsided. Following several recurrences excision of a sinus 2 cm. in length was performed under local anesthesia on August 1, 1946. Healing was prompt.

CASE II. W. G. was a forty-eight year old white male who in 1943, 1946 and 1947 had had three abscesses in the right anterior quadrant of the perianal skin, each of about 1 ounce capacity. The first was simply incised, the second was treated in the hospital under anesthesia by another surgeon who suspected an anal infection and the third began four days before consultation on April 21, 1947. Spontaneous rupture had occurred on the previous day. Following complete subsidence of the inflammatory process inspection revealed a minute opening to the medial side of the broad scar created at the operation performed in 1946. A short sinus tract was removed under local anesthesia on May 16, 1947. Twelve days later the wound had completely healed, but inspection of the left side revealed a second better defined tract of the same nature 2 cm. in length ending in a small point of suppuration. (Figs. 1 and 2.) The second lesion was excised on May 29, 1947, and healing was prompt.

This is a clear instance in which the source of infection had gone unrecognized and a second lesion had almost escaped attention.

CASE III. J. E. B. was a forty-nine year old white male. Following an attack of pneumonia in 1943 a painful area in the left buttock gradually developed in this patient. His regular medical attendant suspected that he had an anal fistula. On examination August 18, 1947, there was seen in the left anterior quadrant an elongated, depressed, reddened, indurated area 3 cm. in length, the medial end of which was a corresponding distance from the anus. A small opening at the lateral end, looking like a patulous hair follicle, admitted a fine probe for a distance of 2 cm. along the long axis of the lesion towards a tender elevation at the medial end. (Figs. 3 and 4.) The opening was discharging thin pus. There was no induration between

FIG. 3. Case III, ostia of fistulous tract seen to the left of the anus.

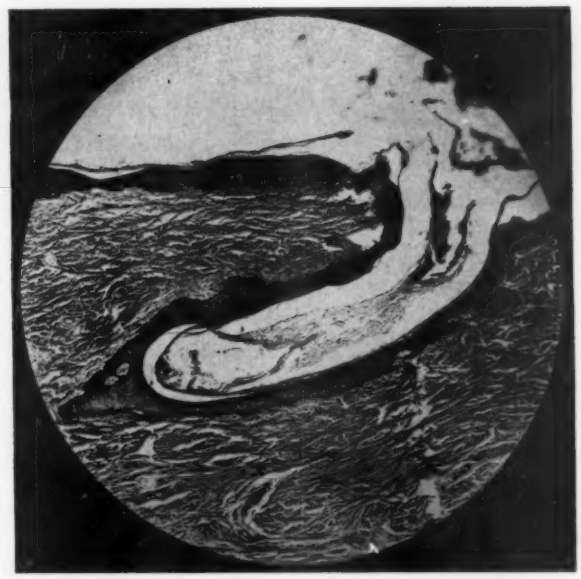

FIG. 4. Case III, photomicrographs of entrance of fistulous tract.

the lesion and the anus and no evidence of an internal opening. Excision was performed on August 25, 1947, and a second suspicious area on the right buttock was also removed. Healing of both wounds took place within ten days.

CASE IV. B. was a white male, an army inductee, who was referred from an induction center to an army general hospital for evaluation of a small recurrent abscess on the left buttock. During the previous two years this patient had had five abscesses in the same area, two of which had been incised, three having opened and drained spontaneously. On examination there was a small, tender, reddened elevation with a crust on its summit near the anus. On careful search a minute opening was discovered 4 cm. laterally, admitting a salivary probe the entire intervening distance without pain and without bleeding on withdrawal of the probe. A fibrous cord could be palpated with difficulty between the two ends of the lesion. (Fig. 5.) Because of the patient's civilian status at the time of examination, operative removal was not permissible. The case is cited as being the longest such lesion encountered.

CASE V. R. H. was a thirty-one year old white male. Four years prior to examination on July 6, 1938, an anterior midline abscess developed in the patient which was incised and persisted in draining for two months. For the past eighteen months there had been alternate swelling and spontaneous rupture and for the last three months continuous drainage. Examination showed two openings in the anterior midline, one smooth and inconspicuous, the other raised and granular, at 2 cm. and 5 cm. respectively from the anus, the latter discharging thin pus. There was an easily demonstrated tract between containing no hair.

In all of the presented cases it is noted that the sinus tracts run parallel to or at an acute angle to the surface; their lengths rest in the corium and do not extend into the subcutaneous stratum and their linings are made up of stratified squamous cells from which no skin appendages arise. The lumina measure from 0.5 mm. to 1 mm. in diameter and contain invariably keratin and never fat. Upon these characteristics this type of sinus is differentiated from that of dermoid and sebaceous gland origin.

The cause of epidermal sinuses could be impaction of exfoliated hairs, metaplasia in subdoriferous and sebaceous glands, traumatic inclusions and disfiguring and scarring infections of the skin.[6] The perianal sinuses in this group have been, in the opinion of the authors, the result of impacted exfoliated hairs which led to distention of the hair sheath.[7] A similar view has been taken by Smith in his discussion of the causes of pseudosinuses of the perineum.

Epidermal sinuses of the perineum may be asymptomatic or reason for complaint if infection is introduced. In Cases V and II evidence of acute inflammation is seen and in Case II, suppuration. Chronic inflammation appeared in Cases I and II and foreign body reaction in Case III. Infectious granulomatous inflammation and neoplasia in epidermal sinuses of the

FIG. 5. Case IV, probe is inserted in lateral ostium of fistulous tract and runs the entire distance of 4 cm. to the medial opening of the tract to the left of the anus.

perineum has not been reported nor shown in the cases of this group.

SUMMARY

The significance of these small lesions lies in their identification as a cause of localized suppuration in the neighborhood of the anus, distinct from true anal fistula, pilonidal sinus and from any epithelium-lined sinus having its origin within the anal canal.

So far as can be determined the lesions described herein are identical with those referred to by N. D. Smith as pseudosinuses and by Anderson as epidermal fistula. In view of the pathologic findings and the apparent origin from hair follicles, the name epidermal fistula is acceptable.

The treatment is far simpler than that for any of the lesions with which it may be confused. Drainage of any acute abscess followed by complete excision of the tract under local infiltration anesthesia can be performed usually without hospitalization.

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CHORIO-EPITHELIOMA FOLLOWING HYSTERECTOMY*

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THERE are many articles discussing chorio-epitheliomas in the literature. However, only three cases were found in which death occurred from metastases longer than three years following the removal of the uterus.[1–3] Several cases are in the literature in which the chorio-epithelioma appeared at varying intervals following either pregnancy or menopause.[1,4,5] The validity of the latent period in such cases, however, is difficult to prove. According to Brown et al.[2] the latent period in chorio-epithelioma is accepted as indicating the time of existence of the retained placental chorion before the first appearance of symptoms of malignant development. Because of the inherent uncertainty of such dates, except in instances of hysterectomy or bilateral oophorectomy, the validity of many reported latencies is open to question. Teratomatous origin of this malignancy must be considered even when a hysterectomy has been performed in order to state categorically that a latent period has been present. Outerbridge[4] in an excellent review reported thirty-five cases of chorio-epithelioma with latent periods of two years or longer. He also discussed the difficulty in establishing this latency period. None of Outerbridge's patients had either ovarian or uterine surgery. Dorr and Cutler[5] reported a case of a seventy year old female in whom a chorio-epithelioma developed fifteen years following menopause and thirty years after her last known pregnancy. As no hysterectomy or oophorectomy was performed at or about the time of the last known pregnancy, the validity of this long latent period has been questioned.[2]

Only three cases were found in a review of the literature in which a latent period of three years or longer was established by either bilateral oopherectomy or hysterectomy. A summary of these cases is as follows:

Dockerty and Craig[1] reported a twenty-nine year old white female who complained of headache, weakness and blurred vision. The patient had the uterus removed four years previously following a diagnosis of hydatidiform mole. No symptoms relative to the pelvis were noted from the time of the operation until her admission to the hospital. At this time a diagnosis of primary brain neoplasm was made and a craniotomy was performed. Pathologic examination of the tissue from the right cerebral hemisphere showed a chorio-epithelioma. Death occurred six weeks postoperatively.

The case of Brown et al.[2] was of a thirty-two year old white female who had a productive cough, hemoptysis of five months' duration, chest pain and loss of weight. Curettement was done for an apparent abortion of a two months' pregnancy nine years preceding death. The tissue obtained at operation showed a hydatidiform mole. Two years after the curettage a hysterectomy was performed. No tumor was found in this specimen. Approximately six years following the hysterectomy a diagnosis of bronchogenic carcinoma was made. Death occurred nine months following the onset of pulmonary symptoms and seven years following the time of the hysterectomy. Choriocarcinomatous tissue was present in the lungs and kidney. A purified aqueous extract of both the tumor and formalin in which it had been fixed gave a definite positive Friedman reaction.

Cary's case[3] was that of a thirty-seven year old white female who aborted about the sixth week of pregnancy. Intermittent uterine hemorrhages occurred during the subsequent five months, at which time a panhysterectomy was done. The uterus and adnexa showed masses of hydatid-like sacs. Three years following this operation she was again hospitalized with backache, aching in the hips and abdomen, and chronic constipation. Death occurred six weeks following this last admission and three years after the hysterectomy. At autopsy the chorio-epithelioma was found in many of the viscera.

We have recently studied at autopsy a female with a chorio-epithelioma involving many of the viscera who had a hysterectomy seven

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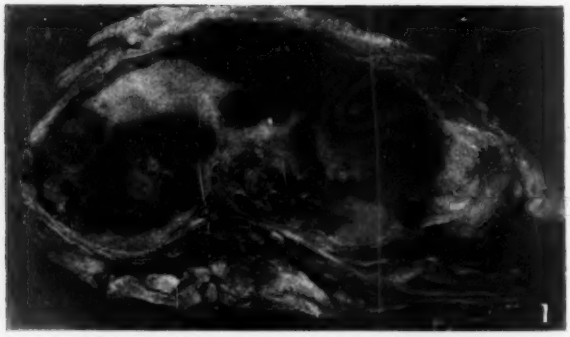

FIG. 1. Right shows extensive infiltration of tissue by tumor; note areas of hemorrhage. Microscopically, the involved areas showed chorio-epithelioma.

years previously. The pertinent data are as follows:

CASE REPORT

F. S., a forty-three year old Latin American female, came to the clinic with the chief complaint of "bloody urine" for two weeks. There was no history of dyspnea, frequency of urination, nocturia or any gastrointestinal complaint. Two months prior to admission she had transient episodes of sharp pain in the lower portion of her back, especially on the right side. Accompanying this pain was anorexia and vomiting. The patient stated that she had lost 10 pounds in weight during the past two months.

The patient was a gravida VII, para VII. The last known pregnancy was twelve years prior to the time that her uterus was removed. No miscarriages were admitted. A supravaginal hysterectomy was performed seven years preceding the time of her death. The operation was performed because there was extensive metrorrhagia. No pathologic study was made of the uterus; however, her physician stated that the uterus at the time of the operation showed fibromyomas.*

The patient was admitted from the clinic to the hospital. She appeared chronically ill, pale and stuporous. There was dullness to percussion and increased breath sounds in the left lung anteriorly. A deep cervical laceration and a cystocele were present with a thick yellow vaginal discharge. The urine had a specific gravity of 1.012, acid reaction and the albumin was 2 plus. There was no sugar in the urine. Many red blood cells were present per high power field. A hemogram showed the hemoglobin to be 5.8 gm. per cent, white blood cells

* Personal communication from doctor.

FIG. 2. Section of a metastatic tumor nodule from the lung; note multinucleated giant cells with hyperchromatic nuclei. We consider this chorio-epithelioma. N. P. stain; × 240.

13,000 with a moderate shift to the left. The non-protein nitrogen was 55 mg. per cent. The sputum was negative for acid-fast organisms. The serologic tests were negative. A roentgenogram of the chest showed small, irregular, round nodules extensively infiltrating both lung fields.

The patient continued to run an elevated temperature, progressively grew worse and died on the fourth day of hospitalization.

A complete autopsy was performed twenty-six hours following death. Only the pertinent findings, however, were included in the following pathologic report: Tumor masses were present in the lungs and kidneys (Fig. 1), liver and spleen, and wall of the stomach and ileum. The peritoneum covering both the ovaries was involved. These nodules in some areas were relatively firm in consistency and glistening in appearance, while other portions were necrotic and hemorrhagic. Some of the masses were 3 cm. in diameter. They were composed of sheets and cords of large, pale, polyhedral-shaped and pink-staining cells with indistinct outlines. (Fig. 2.) The nuclei were large and hyperchromatic; few mitotic figures were seen.

Multinucleated cells frequently were present. In some areas the cells were found to be similar to those present in the syncytial and Langhan's layer of a chorionic villus. Blood vessels were invaded by the tumor cells in many areas. Leukocytes were present in the areas of hemorrhagic and necrotic tissue. No tumor was present in the wall of the vagina or the stump of the cervix.

Anatomic diagnoses revealed a history of supravaginal hysterectomy for metrorrhagia seven years preceding death; chorio-epithelioma involving lungs, kidneys, liver, spleen, wall of stomach and ileum, and peritoneum covering ovaries; primary lesion in uterus (?) and chronic cervicitis.

COMMENTS

Sanger first described chorio-epithelioma as a tumor of chorionic tissue in 1888.[6] Since that time there has been considerable confusion with regard to nomenclature as well as to the site of origin of this neoplasm. It is generally accepted at this time that these tumors arise in syncytial and Langhan's layers of the chorionic villi.

We have presented a case in which hysterectomy was performed seven years prior to death. The gross and microscopic findings at autopsy were typical of a generalized chorio-epithelioma. In view of the presence of this type of neoplasm in a patient without a uterus, the ovaries and all midline structures were carefully examined for evidence of a teratomatous origin for this neoplasm. The ovaries were small and several implants were present on the surfaces. There was nothing in the mediastinum or the sacral region to suggest a primary growth. Although the uterus from this patient was not examined satisfactorily when removed seven years previously, it is suggested that the primary lesion was uterine and a latent period of seven years elapsed before death resulted from the metastases. Although chorio-epitheliomas frequently result in death only a few weeks or months following the original tumor, there is a case reported in which the patient lived for twenty-one years.[7] The clinical data and results of operative treatment in chorio-epitheliomas are reviewed in an excellent article by Vineberg. He states, "It is generally agreed that there are two varieties of chorio-epithelioma, the one highly malignant, the other semi-benign. Several eminent pathologists emphatically stated they were unable to recognize any histological difference."[7]

In support of the opinion that our patient may have had the original tumor within the uterus and a latent period of seven years did occur following hysterectomy is the observation that regression and disappearance of metastases occurred for more than two years in Rockafellow's case.[8] Several other cases are cited by Vineberg[7] in which tumors in the uterus and vagina, apparently chorio-epitheliomas, regressed either spontaneously or following partial removal.

Chorio-epithelioma, because of its diverse and often misleading clinical and pathologic manifestations, is without doubt one of the most puzzling gynecologic conditions to prognosticate. Tumors appearing relatively benign frequently run a rapidly fatal course, while tumors appearing highly malignant may occur in patients making uneventful, complete recoveries.[9]

Cary[3] says, "A choriocarcinoma may be malignant and a chorioadenoma usually benign or much less malignant, the picture may change and a tumor which at first appears benign may later become malignant. Therefore, if an apparently benign case may later become malignant, why is it not reasonable to assume that an apparently malignant case may retrogress and become benign, especially inasmuch as the more benign cases are conceded to be retrogressive forms of the once typical chorio-epithelioma?"

The longest proven period reported for the development of chorio-epithelioma following hysterectomy is seven years.[2] Our case also has a seven-year latent period. There are no satisfactory theories to account for this latent period. Ries[10] found well preserved chorionic villi in the uterine vessels of a patient who had been pregnant eighteen years previously. Examination revealed an entirely benign process. Allen and Allen[11] report Frankel's work on trying to show that a chorionic cell which normally invades the blood stream is usually destroyed by a lytic substance which he found in the serum during pregnancy. He observed a lack of this lytic substance, however, in some women in whom a chorio-epithelioma developed. These observations of Frankel have not been confirmed so far as we know.

Chorio-epithelioma is considered a rapidly growing and destructive process which usually

results in death within a week to eighteen months following either a normal or abnormal pregnancy directly or a hydatidiform mole. The great invasive and destructive nature of the tumor is shown by the widespread metastases as reported.[1,3,7,12] Central nervous system involvement, also, has been found.[1,5] In an analysis of many cases of chorio-epithelioma, Tew[12] found cerebral metastasis in only 5 per cent. Brown's case[2] showed widespread metastasis similar to ours. We believe that more information should be obtained with regard to the latent period in the development of chorio-epithelioma. This can be accomplished by a careful follow-up of patients who undergo pelvic surgery following either pregnancy or hydatidiform moles. The need for this information is evident from the few valid cases now reported.

SUMMARY

A case is reported in which death occurred from a metastatic chorio-epithelioma seven years following hysterectomy. It is suggested that the primary lesion was in the uterus. Only one case was found in the literature in which the latent period was seven years. These are the two longest proven latent periods in the development of chorio-epithelioma reported.

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PRIMARY MESENTERIC THROMBOSIS TREATED WITH RESECTION AND ANTICOAGULANTS*

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MESENTERIC vascular thrombosis and occlusion was first reported by Tiedeman[1] in 1843. Elliott[2] in 1895 reported the first successful intestinal resection for the condition. The most recent survey of the literature was made in 1944 by Ficarra[3] who found that about 554 cases had been reported, to which he added fifteen additional cases making a total of 569. In this entire group bowel resection was successfully performed with survival of the patient in only thirty-five cases (6.1 per cent). In a survey of the English literature[4–17] since Ficarra's publication we have found forty more cases, of which sixteen patients recovered. Including the two cases reported herein there are now 611 cases in the literature, with fifty-three patients surviving various forms of management (8.6 per cent).

Excluding those cases of mesenteric vascular occlusion resulting from local infections and trauma (e.g., gangrenous appendicitis and strangulated bowel) the incidence of the disease is rare. Laufman and Scheinberg[17] reported the condition occurring forty-four times in 41,982 surgical admissions over a period of ten years at the Michael Reece Hospital, and Rives, Strug and Essrig[16] reported nineteen cases in 55,232 surgical admissions at Touro Infirmary.

According to Trotter,[18] the disease is more common in males and it is most frequent during the age of 30 to 70 years of life.

Recent literature has added little to our knowledge of the etiology of the disease. Trotter[18] believed 60 per cent of his cases were caused by aterial occlusion and the remainder were caused by venous obstruction. Sixty per cent of the arterial occlusions were due to emboli. Emboli may come from vegetations in the valves of the left side of the heart, from mural thrombi in the left side of the heart and from atheromatous plaques. The reasons for arterial and venous thrombosis are more obscure and the answer here awaits the explanation of the phenomenon of intravascular clotting occurring much more commonly in the heart, the brain and the lower extremities. On the arterial side, thrombosis has been attributed to mesenteric arteriosclerosis and thromboangitis obliterans. On the venous side, portal hypertension due to cirrhosis of the liver, congestive heart failure, pressure from tumors, adhesions or congenital bands may play a part. In many instances the disease appears to occur spontaneously and without cause. Indeed, as far as the local pathologic picture is concerned the etiology appears to make little difference. In the involved bowel following either arterial or venous blockage the familiar picture occurs of edema, deep red discoloration, gangrene, accumulation of bloody fluid in the bowel and the peritoneal cavity and, finally, if the lesion goes untreated, perforation of the bowel. Since the pathologic result is the same, the cause of mesenteric vascular occlusion will not alter the local management of the condition. However, an early and accurate diagnosis generally may be made more readily when signs and symptoms of an abdominal emergency appear in patients suffering from diseases in which embolic phenomena are prone to occur. There was no significant condition present in either one of our patients that would explain the disease.

TREATMENT

The obvious treatment is laparotomy with excision of the involved segment of bowel and mesentery along with a generous portion of the adjacent normal bowel and mesentery when such are available. The sight of massive infarction of the bowel should not discourage the surgeon. A thorough exploration should be done and an effort made to resect all the involved

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bowel and mesentery. The minimal amount of small intestine compatible with life has not yet been determined. Utilizing modern diet and replacement therapy it is becoming apparent that much less bowel is necessary than previously thought. Meyer[9] removed 22 to 24 feet (671 cm. to 732 cm.) of small bowel and the right half of the colon for mesenteric arterial thrombosis leaving 18 inches (46 cm.) of jejunum, and the patient was well nine months later. Coggswell[14] removed 122 inches (310 cm.) for arterial embolism of superior mesenteric artery leaving 14 inches (36 cm.) of proximal jejunum, and six months later the patient's gastrointestinal tract was functioning satisfactorily although not normally. She was maintained on a high protein, low fat diet and was having four loose stools a day.

The postoperative progression of thrombosis beyond the limits of resection is the concern of surgeons removing bowel for mesenteric vascular occlusion. The advent of anticoagulants in the form of heparin and dicumarol® has built hopes that such extension might be controlled. The use of one or the other of these drugs following operation has been reported by Fox,[5] D'Abreu and Humble,[8] Garvin,[10] Ashley and Benson,[11] and Coggswell.[14] Both drugs were employed in the cases herein reported. Better understanding of gastrointestinal physiology and pathology, the intelligent use of replacement and supportive therapy, the employment of chemotherapy and antibiotics, and aggressiveness on the part of the surgeon to make heroic efforts to save these patients probably account for the increasing number of cures.

Regarding the use of anticoagulants the case reported by Hendry[13] is of particular interest. A sixty-four year old man had a laparotomy at which time 2 to 3 pints (1.1 to 1.7 L.) of spontaneously coagulable blood were found free in the peritoneal cavity. Two upper loops of jejunum were markedly engorged and contracted with the mesentery grossly edematous right up to the border of the intestine. The bowel was considered to be "in a condition of hemorrhagic infarction" but still appeared viable. Therefore, the abdomen was closed because it was believed that the patient's condition was too precarious to allow resection of the bowel. Postoperatively intravenous heparin was given for five days maintaining capillary coagulation time between ten to twenty minutes. Recovery was essentially uneventful. This author pointed out that a spontaneous recovery was noted by Whittaker and Pemberton and another by Ravdin. One is inclined to doubt the diagnosis in cases in which no pathologic specimen is available; furthermore, in Hendry's cases the bowel "seemed still viable," which is far from the case in many instances which greet the operator on opening the abdomen. Anticoagulants cannot yet be recommended as the sole method of treatment but probably should be utilized to prevent possible further spread of thrombosis following resection and their employment kept in mind for those cases in which resection is absolutely contraindicated either because of the precarious condition of the patient or too extensive an infarction. Laufman and Scheinberg[17] cast some doubt on the advisability of using heparin in cases not resected, believing it would cause added loss of blood and fluid into the bowel lumen and peritoneal cavity. This problem apparently did not occur in Hendry's case.

The infrequent occurrence and rare recovery from primary mesenteric vascular occlusion merits the report of two consecutive cases in which the patients were successfully treated with resection of the gangrenous bowel and the use of anticoagulants.

CASE REPORTS

CASE 1. T. Y., aged seventy-four years, was admitted to the hospital on April 2, 1948. The chief complaint was abdominal pain of one day's duration. He had been entirely well up until the day before admission when generalized abdominal pain developed which was most severe around the umbilicus. Eighteen hours after its onset the pain had shifted to the right lower quadrant and was intermittent and cramp-like. One bowel movement had occurred since the illness without blood in the stool. Vomiting had occurred once. The past history was insignificant except for a right inguinal herniorrhaphy twenty-four years previously.

On physical examination the patient was a well developed, well nourished, white male appearing younger than his stated age. The heart was not enlarged. The pulse rate was 110 beats per minute. Blood pressure was 150 systolic and 78 diastolic. There were tenderness and rigidity in the right lower abdominal quadrant. Rectal examination was negative.

Laboratory examinations revealed 1+ al-

bumin in the urine and otherwise was negative. The hemoglobin was 15 gm. (97.2 per cent), the red blood cell count 5,800,000 and the white blood cell count 19,950. The preoperative diagnosis was acute appendicitis.

The operation was performed shortly after admission under spinal anesthesia. Upon opening the peritoneum approximately 500 cc. of unclotted bloody fluid were encountered. The ileum contained an infarcted, gangrenous segment of bowel about 18 inches (45 cm.) in length. The gangrenous portion was resected and an end-to-end anastomosis was done. The abdomen was closed with a small tissue drain down to the peritoneum.

The pathologist reported that the excised tissue of small bowel showed marked hemorrhagic and inflammatory cell infiltration of the entire intestinal wall with beginning degenerative changes. The diagnosis was gangrenous segment of small bowel due to mesenteric thrombosis.

Gastric suction was instituted immediately after operation. Intravenous heparin, 100 mg., was given three hours following surgery. Beginning twelve hours after surgery 300 mg. of heparin in Pitkin's menstruum were given every other day for three doses. This kept the clotting time between twenty and twenty-five minutes by the Lee and White method. On the fifth postoperative day the gastric suction was discontinued. Dicumarol,® 300 mg., was given on the fifth day, 200 mg. on the sixth day and 100 mg. on the seventh day postoperatively. The prothrombin time came down to 14 per cent of normal. An ileus then developed and it was necessary to pass a Miller-Abbott tube and reinstitute continuous suction. The patient made a satisfactory recovery and on the tenth postoperative day another 300 mg. of dicumarol® were given. The bowels functioned normally and the patient was discharged from the hospital on the twenty-fourth hospital day. The wound healed satisfactorily.

CASE II. S. K., a white male aged seventy-seven years, previously in good health, suffered a sudden onset of pain in the right lower abdomen at 8:30 A.M. on December 16, 1948. He vomited once and was seen by the surgeon at about 3:00 P.M. at which time he passed a bloody stool. The past history was negative except for an inguinal herniorrhaphy which had been performed on the right side in 1908.

General examination was essentially negative except for tenderness and rigidity in the right lower abdominal quadrant. Laboratory examination of the urine demonstrated a small amount of albumin and a few hyaline and granular casts. There were four to eight pus cells. The hemoglobin was 15 gm. (97.2 per cent), the red blood cell count 5,420,000 and the white blood cell count 24,550. A preoperative diagnosis of mesenteric thrombus was made.

FIG. 1. Microscopic section of anastomosis showing complete healing of the bowel.

At operation at 5:00 P.M. on December 16th the distal ileum was found to contain an infarcted, gangrenous segment of ileum about 30 inches (76. cm.) long. There were about 700 cc. of unclotted bloody fluid in the peritoneal cavity. The gangrenous ileum was resected and an end-to-end anastomosis made.

A Miller-Abbott tube was passed down the throat into the stomach and was threaded through the duodenum. Three hours after the operation 50 mg. of heparin were given intravenously and repeated at four-hour intervals for three doses. Twenty-four hours after the surgery 300 mg. of heparin in Pitkin's menstruum were given subcutaneously. This was repeated on the third and fourth postoperative days. By the sixth postoperative day the patient, tolerating medication by mouth, was given 300 mg. of dicumarol® followed with 200

mg. on the next day. This lowered the prothrombin time to 7 to 30 per cent of normal. Dicumarol,® 100 mg., was given on the eleventh, twelfth and thirteenth postoperative days and the prothrombin time was maintained at 30 per cent of normal until the eighteenth postoperative day when the prothrombin time was allowed to return to normal. The patient was up and around and had made a satisfactory recovery to merit discharge home, but because of an auricular fibrillation which had developed about the fifteenth day he was kept in the hospital. On the eighteenth postoperative day there was acute retention of urine. The patient had not been catheterized before and this was rather surprising. It became necessary to catheterize him repeatedly and on January 8, 1949, a first stage transurethral prostatic resection was done, removing 30 gm. of tissue. He still could not void following this procedure and on January 13th he had a second stage transurethral prostatectomy at which time 50 gm. of tissue were removed. This latter operation was prolonged and the patient developed a chill, went into shock and died about six hours after completion of the procedure. Autopsy showed no evidence of disease in the abdomen. There was no sign of any further progression of the thrombosis. Figure 1 is a microscopic section of the anastomosis showing complete healing of the bowel. In spite of the fact that the patient died from another disease it seems rational to report this case as recovery from a mesenteric thrombosis.

SUMMARY

A survey of the literature on mesenteric vascular occlusion indicates that about 611 cases have been reported. Of these, fifty-three patients have recovered and eighteen of these recoveries have been reported in the past four years. It is apparent that better understanding of gastrointestinal physiology and pathology, the use of chemotherapy and antibiotics, employment of supportive therapy, aggressiveness of the surgeon and possibly anticoagulants are saving an increasing number of patients ill with this usually highly fatal disease.

Two new, successfully treated cases are reported.

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BENIGN STRICTURE OF THE COMMON BILE DUCT*

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A HIGH percentage of the strictures of the common bile duct are preceded by biliary tract surgery. Cole[1] states that in 75 per cent of the cases of common bile duct stricture treated at the Illinois Research Hospital there was a history of previous biliary tract surgery. Cole cites figures by Cattell indicating previous operative injury to the duct in 80 per cent of the cases of stricture of the duct treated while Walters reported a relationship of 90 per cent of his cases. The occasional cases of stricture of the common duct not related to operative injury are usually caused by an inflammatory process severe enough to produce fibrosis of the tissues in or about the duct. In rare instances gallstones in the duct with the associated long-standing inflammatory condition is the significant factor producing the stricture. A stone impacted in the duct at the ampulla of Vater has occasionally resulted in a stricture of the common bile duct. A limited number of these lesions have resulted from the severe inflammatory reaction associated with a duodenal ulcer. However, the case history of a patient suffering from stricture of the common bile duct most often reveals previous biliary tract surgery. (Figs. 1 and 2.)

PREVENTION OF COMMON DUCT INJURIES

The prevention of stricture of the common bile duct is dependent in most instances upon proper surgical technic at the time of cholecystectomy. Failure to identify accurately the junction of the cystic and common duct may result in injury. An extensive inflammatory reaction may obscure the structures and cause difficulty for the operator in identifying the junction of the cystic and common ducts. In difficult cases it is often wise to remove the gallbladder from above downward. There is usually more bleeding from the liver bed when this method is used but often there is less risk of surgical trauma to the ducts. The anomalies frequently present in the duct system present another situation in which identity of the cystic and common duct junction is difficult. If a practice is made of determining the point where the cystic and common ducts actually join rather than assuming the junction is normally situated, operative injury may be avoided in most cases.

Operative records of patients who have strictures of the common duct reveal that one of the chief difficulties encountered during the previous cholecystectomies has been hemorrhage. The necessity of clamping only the bleeding point in instances in which hemorrhage occurs has been repeatedly stressed. Digital compression of the hepatic artery will usually control the hemorrhage from the cystic artery, temporarily enabling the surgeon to visualize the bleeding point and permitting a clear operative field. This is accomplished by inserting the index finger into the foramen of Winslow and compressing the hepatic artery between the thumb and index finger. Experienced surgeons have frequently called attention to the necessity of adequate exposure, good illumination and proper anesthesia.

Injuries are not limited to trauma under unfavorable circumstances such as difficulty in identifying important structures, puzzling anomalies of the duct system and hemorrhage. In some cases of duct injury reference to the original record reveals that the operation was considered to be technically easy. This may be due to the fact that when traction is applied to the gallbladder the common duct can easily be pulled up in line with the cystic duct and in this position can be blindly clamped without the knowledge of the operator. (Fig. 3.)

OPERATIVE METHODS FOR MANAGEMENT OF STRICTURE OF COMMON BILE DUCT

The many different procedures carried out in the reconstruction of the common bile duct actually have been deviations of two general principles, namely, end-to-end suture of the common duct and the implantation of the proximal end of a strictured duct into some

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portion of the gastrointestinal tract. Recently another procedure was introduced by Longmire[2] which entails resection of a portion of the left lobe of the liver and anastomosis between the left intrahepatic duct and the jejunum.

The end-to-end anastomosis of the duct is in that it may be removed when desired. (Fig. 4.)

The second principle, implanting the proximal end of the duct into some portion of the gastrointestinal tract, has been used with numerous variations. In many instances cho-

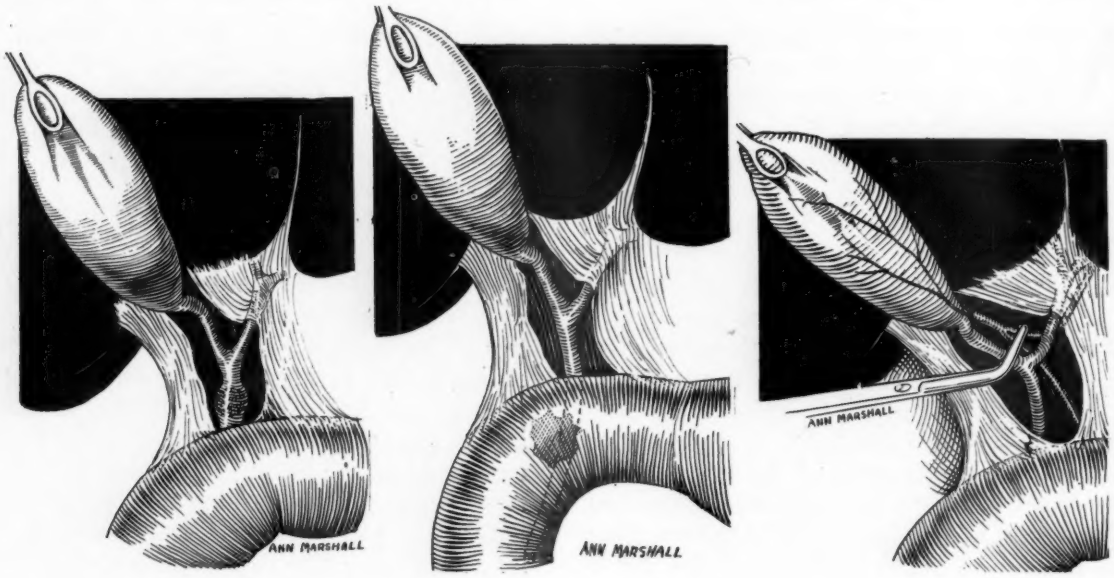

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FIG. 1. A stone impacted in the common bile duct very occasionally produces ulceration and fibrosis which is followed by stricture of the duct.

FIG. 2. Drawing shows region of posterior wall duodenal ulcer about which the inflammatory reaction might produce a stricture of the common bile duct.

FIG. 3. Traction on the gallbladder may displace the hepatic artery or the common duct during cholecystectomy. Accurate visualization and demonstration of the structures is necessary to prevent injury.

the best method in cases in which this is possible. Cattell[3] and Lahey[4] have stressed reflecting the duodenum medially and splitting the head of the pancreas in order to expose the distal retroduodenal portion of the duct. After the duct has been definitely identified, the stenosed area of the duct is excised. The end-to-end anastomosis is usually accomplished over some type of catheter or supporting structure. At one time vitallium® was regarded as somewhat superior for this purpose. However, later observations indicated that it offered no advantage over the catheter or rubber tube. It is more advantageous to perform such anastomoses over a catheter or T tube which can be brought to the outside in some manner to provide adequate drainage of the common bile duct as long as necessary. Cattell[3] has emphasized the value of inserting the catheter or T tube in the common duct either above or below the anastomosis and bringing it to the outside. The catheter offers another advantage

ledochoduodenostomy is done. In other cases the anastomosis has been between the proximal duct and stomach or jejunum. Allen[5] popularized the use of the Roux Y limb of the jejunum to the proximal end of the common duct which appears to involve less danger of ascending infection. We believe this procedure is more satisfactory than choledochoduodenostomy. (Fig. 5.) We also believe an accurate anastomosis of the mucosa of the duct to the mucosa of the intestine is very important and that in general a more satisfactory anastomosis can be accomplished if it is performed over some type of catheter which can be brought to the outside and can be removed when desired. (Fig. 6.)

Intrahepatic cholangiojejunostomy with partial hepatectomy as introduced originally by Longmire[2] and as modified by Wilson and Gillespie[6] offers a new and radical approach of value in certain difficult cases. The left intrahepatic bile duct is identified by resecting a

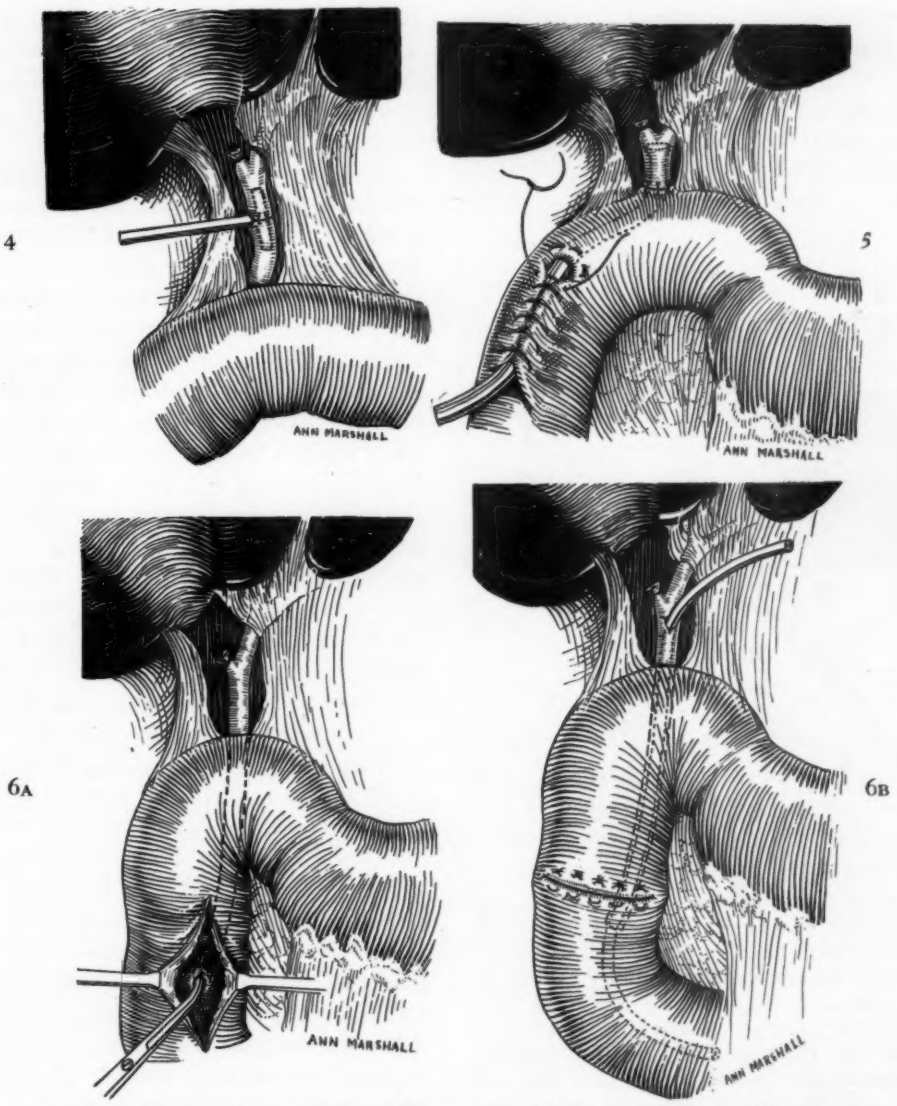

FIG. 4. End-to-end anastomosis of the common duct over a T tube after resection of the narrowed portion of the duct. It is usually wise to bring the catheter out of the duct through an opening either above or below the anastomosis rather than at the site of suture as illustrated.

FIG. 5. Illustration of one method of accomplishing choledochoduodenostomy. In many instances the anastomosis is performed over a short rubber tube which is not brought outside the duodenum as illustrated. Choledochojejunostomy utilizing the Roux Y principle as emphasized by Allen is often preferable to the method illustrated.

FIG. 6. A, stricture of the duct at the ampulla of Vater at times is best treated by a transduodenal approach with division of the stricture under direct vision; B, transverse closure of duodenum in order to preserve the lumen of the viscus.

portion of the left lobe of the liver and an anastomosis performed between the duct and jejunum. This type of anastomosis is particularly helpful in cases in which almost no remnant of the duct remains. (Fig. 7.) Since the introduction of this new procedure two successful cases have been reported upon by Wilson and Gillespie[6] and by Sanders.[7] The following is a resume of a case previously reported by Wilson and Gillespie in which the modified Longmire procedure was utilized:

CASE REPORT

A forty year old white male was admitted to our service in January, 1948, complaining of jaundice accompanied with recurring fever and

chills. He was markedly jaundiced. Tenderness was noted beneath the right costal margin. The stools were clay colored and further inquiry revealed there had been a loss of 40 pounds of weight. The patient's past history revealed he had undergone cholecystectomy sixteen months

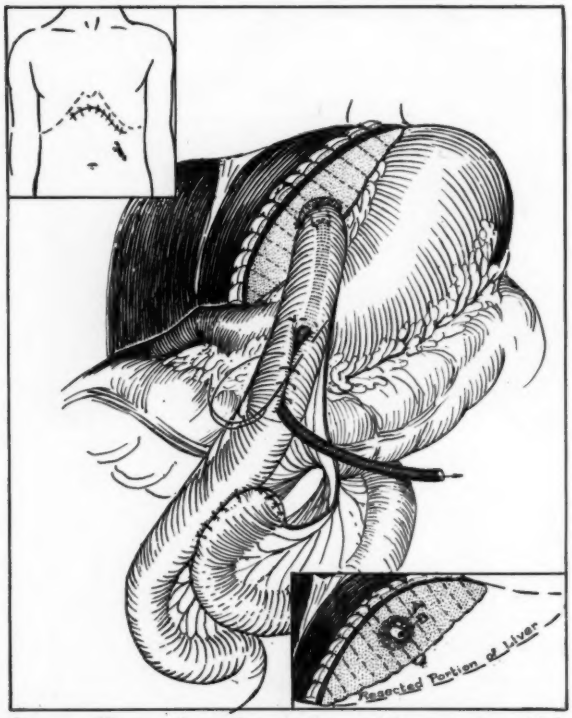

FIG. 7. Illustration of technic used in case in which partial hepatectomy and intrahepatic cholangiojejunostomy was done because of inability to demonstrate any portion of the common bile duct. Left upper inset shows type of incision used with stab wound shown for drainage. The central drawing illustrates anastomosis between a Roux Y limb of the jejunum and the left intrahepatic bile duct; anastomosis performed over a catheter which was brought to the outside by the Witzel method. Right lower inset shows method of controlling hemorrhage from liver by the use of overlapping mattress sutures tied over a strip of gelfoam. A, illustrates small artery which accompanies left hepatic duct which is labeled (B); small portion of liver parenchyma adjacent to the duct has been curretted away.

previously and at the time had been told the gallbladder contained many stones. His postoperative course was uneventful with the exception of an unusually profuse drainage of bile from the wound for several days. Sometime after the operation he began to experience attacks of jaundice which varied in intensity. An exploratory laparotomy was performed on March 21, 1947, and he was told no obstruction existed in the bile duct. On February 3, 1948, an exploratory laparotomy was performed and a definite common bile duct could not be identified. However, when an area was incised in the hilus of the liver, a small amount of bile could be seen flowing out; and this area was anastomosed to the duodenum.

It soon became apparent that the newly established communication was not functioning satisfactorily. On March 13, 1948, partial hepatectomy and cholangiojejunostomy were done. A modified V type incision was made beneath the costal margin. The triangular ligament supporting the left lobe of the liver was divided and the left lobe of the liver delivered into the wound. Overlapping mattress sutures were utilized to control bleeding while resecting the left lobe of the liver. Upon accomplishing resection of the lateral two-thirds of the left lobe a small bile duct was identified and catheterized with a No. 14 French catheter. The liver tissue immediately adjacent to the duct was removed and an end-to-end anastomosis between the Roux Y loop of the jejunum and the bile duct was done.

The catheter was brought out of the Roux Y limb of jejunum by the Witzel procedure. Liver tissue removed at operation revealed the presence of a rather diffuse hepatitis which was not unexpected in view of the patient's long history of biliary tract infection. The postoperative course was characterized by fever and some drainage from the abdominal wound. Bile was present in the stool on the third postoperative day. Twelve days after the operation a partial wound disruption developed which required secondary closure. The patient gradually improved. When last seen he was no longer jaundiced, he had gained approximately 20 pounds in weight and had returned to his normal occupation. The serum bilirubin curve was approximately normal. The patient was apparently in good health eighteen months after the repair.

Strictures in some instances develop at the site of repair and it is impossible to determine whether a patient is permanently cured until long periods of time have elapsed. The abdominal surgeon should be thoroughly familiar with the various types of repair which have proved useful in the management of these most difficult and varied lesions.

SUMMARY AND CONCLUSIONS

1. Stricture of the common bile duct is most often due to operative trauma. However, in-

flammatory processes in or about the duct may occasionally result in a stricture.

2. The difficult situations often encountered during biliary tract surgery are pointed out together with surgical technics most helpful in avoiding operative injury.

3. The method of repair of common duct stricture is dependent on the location and type of stricture.

4. The value of partial hepatectomy and intrahepatic cholangiojejunostomy in difficult cases is discussed and a case utilizing this method reviewed.

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In a few recent cases of tuberculosis of the fallopian tubes in which a tuberculous peritonitis also developed excellent results were obtained by the use of streptomycin. This antibiotic can be injected into the peritoneal cavity, especially after a paracentesis, before removing the trocar—or it can be given parenterally. A few surgeons have even injected streptomycin into the adnexal masses. Many of these cases apparently are completely cured by this antibiotic and many an operation may thus be avoided. (*Richard A. Leonardo, M.D.*)

DUODENAL DIVERTICULA*

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INCREASING interest in duodenal diverticula has become evident in recent years as the realization has grown that these structures may produce disabling symptoms. Improvements in roentgenologic technic have furthered the recognition of these outpouchings of the duodenal wall. According to most authors the first description of a duodenal diverticulum was that by Chomel in 1710. In this instance a duodenal pouch containing twenty-two gallstones was found in an eighty year old woman dying from apoplexy. Various other observers, including Morgagni in 1761, Rahn in 1796 and Fleischman in 1815, reported duodenal diverticula. In 1913 Case first demonstrated by x-ray examination four instances of duodenal diverticula, and he further exhibited films of these cases at the Scientific Exhibit of the American Medical Association meeting in the same year.

Incidence. According to Case's[6] report in 1920 duodenal diverticula were found in eighty-five cases of 6,847 barium meal studies, an incidence of 1.2 per cent. Spriggs and Marxer[29] in 1926 stated that duodenal diverticula were present in thirty-eight cases of 1,000 consecutive roentgenologic examinations of the gastrointestinal tract.

According to Edwards[9] the total number of gastrointestinal x-ray examinations performed during the interval 1925 to 1937 at Kings College Hospital was 11,362, and of this number diverticula were recognized in eighty-five cases, an incidence of 0.75 per cent. In 1943 Warren and Emery[31] reported an occurrence of 2.3 per cent in their series of 103 cases at the Peter Bent Brigham Hospital.

Dunstan, Lowance and Jones[7] in 1949 cited an incidence of 2.2 per cent in 1,350 barium examinations of the upper intestinal tract. Ackermann[1] in 1943 developed the technic of injecting plaster of paris into the duodenum in postmortem cases in an effort to gauge the frequency of duodenal diverticula. By this means he demonstrated diverticula in eleven of fifty subjects.

The distribution with regard to sex is approximately equal. After a review of the available statistics,[8–13,33] it appears that the incidence of duodenal diverticula is closely related both to a realization that such lesions do exist and to a thorough roentgenologic search of the duodenum.

Etiology and Pathology. The exact cause of a duodenal diverticulum is not known. Various theories have been advocated in an effort to explain the outpouching. Edwards[8,9] has written extensively concerning the "locus minoris resistentiae," a mucosal area of weakness through which the vessels transit. There is rather general agreement[10,22] that such an area of lessened resistance does exist at the point of entrance of blood vessels into the duodenum. The frequent occurrence of diverticula in the second part of the duodenum, particularly about the ampulla, is attributed to a weakening of the wall in this area by virtue of passage of the common bile and pancreatic ducts.[3] In this connection MacLean[19] suggests that heterotopic pancreatic tissue present in the duodenal wall possibly serves to weaken the latter.

The question of increased intraluminal pressure in the formation of diverticula is unsettled at this time. That such a factor may well play a role is emphasized by certain observers who contend that the dynamics involved are comparable to those at work in pulsion diverticula of the esophagus. Bockus[3] is of the opinion that there is a loss of the normal perivascular stroma together with a possible deficit of intrinsic muscular tone associated with advancing years.

At the present time disparity exists with reference to the terminology of various types of duodenal diverticula.[3,22] In general, however, diverticula have been divided into true and false types. A true diverticulum is considered one in which the wall is composed of all the normal layers of the duodenum, a false diverticulum one in which the muscular coats are lacking and there is herniation of the mucosa

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through the defect in the muscularis. In addition, the terms pseudo and genuine are often used. Pseudo indicates a relative outpouching due to an associated scarring, such as from a duodenal ulcer; genuine signifies a diverticulum of a true or false nature.

The designations congenital and acquired, primary and secondary, are likewise referred to in discussions of diverticula. Various theories have been advanced supporting the congenital nature of diverticula although it must be conceded that discovery of duodenal diverticula in infants and children by x-ray examination or at autopsy is extremely rare. On the other hand, Spriggs and Marxer have followed the enlargement of diverticula in adults by serial x-ray examinations.

It is difficult to determine whether a diverticulum is basically congenital or acquired, and as Bockus emphasizes, there is no way in which this distinction can actually be made. It is of far greater importance to recognize that a diverticulum may cause symptoms.

It is of interest that diverticula may range from the size of a pea to the size of a pear.[4] They are characteristically ovoid in shape, somewhat resembling a flask.

Location. The vast majority of duodenal diverticula project from the concave aspect of the duodenum in the second, third and fourth portions. According to Warren and Emery, 65 per cent of the cases are located in the second portion, 15.5 per cent in the third portion and 8.7 per cent in the first portion. In 6.8 per cent of the cases there are multiple diverticula. Similar figures have been presented by others interested in these lesions.[8,13] Bockus states that approximately 75 per cent of the pouches are located in the second part of the duodenum, a greater majority of these occurring adjacent to the ampulla of Vater, aptly termed perivaterian diverticula. There is unanimity of opinion that a true diverticulum rarely ever occurs in the first part of the duodenum. Most of the pouches described in this area arise as a result of duodenal ulcer or by virtue of traction upon the duodenum from adhesions, and so properly termed pseudo diverticula.

Diagnosis. Various symptoms may point to the possibility of the presence of duodenal diverticula, but it remains for careful roentgenologic study actually to demonstrate the lesions.[10,16,17] In this connection various technics have been utilized to aid in the discovery of diverticula which would not otherwise be visualized. Changes in position during fluoroscopy and the use of compression devices have been advocated. Also, the use of four- to six-hour retention films is of great value and represents an important feature in the study. A preliminary scout film of the abdomen should be taken to aid in differentiating diverticula from other opaque shadows not due to barium. Calcified lymph nodes, pancreatic stones, renal calculi and gallstones all must be considered and ruled out if not present.

No characteristic symptom complex is present. The symptoms vary from those of a vague and indefinite nature to those of a very disabling character. They may mimic those usually attributed to either peptic ulcer or to gallbladder disease. The incidence of symptoms in cases of known diverticula has been reported as ranging from 8 per cent to 47 per cent. When symptoms are present, pain and discomfort of varying intensity are the most prominent. Typically, pain occurs at a varying interval after meals and is usually located above and to the right of the umbilicus. At times there is associated nausea, due probably to distention of the diverticulum and occasionally vomiting.

Another fairly constant system is that of a heavy feeling occurring in the epigastrium soon after intake of food. This feeling persists usually for an indefinite period and is probably related to distention of the diverticulum with food. With a change in position of the patient, drainage can often be promoted and this discomfort will be alleviated. Diarrhea occurs at times and has been attributed in part to the putrefactive action occurring in the contents of the pouch and to a decrease in external pancreatic secretion due to mechanical obstruction. Although the usual signs of inflammation may be masked, at times tenderness in the right lower portion of the epigastrium is present along with an associated febrile reaction. Case summed up the symptoms as mild and prolonged indigestion, "bilious attacks," anorexia, nausea and vomiting, abdominal distention, mild and persistent pain, and general debility. Occasionally hematemesis or melena occurs.

When one conceives that any type of gastrointestinal complaint may be due to a duodenal diverticulum, the diagnosis is facilitated. It

should be emphasized that even after a definite diagnosis has been established, it does not necessarily follow that the outpouching is the cause of the symptoms present. Accordingly it is essential to rule out other possibilities, and this should include an adequate survey of the entire gastrointestinal tract and related structures, such as the gallbladder and pancreas. After this has been accomplished, one must then decide the exact role played by the duodenal diverticulum.

Treatment. In all cases of duodenal diverticula in which symptoms are present it is recommended that adequate medical management be instituted. This entails an ulcer regime, which should include frequent feedings, preferably of warm milk or other acid-neutralizing foods, and administration of antacids together with belladonna when there is concomitant spasm of the duodenum. Mineral oil is thought to be well tolerated and of some value. Spriggs and Marxer recommend postural drainage, particularly if the diverticulum is large and dependent. Rest, proper diet, avoidance of large meals and gentle massage over the area of the duodenum may give relief according to Guthrie and Brown.[13]

Symptoms of a moderate to a severe nature occurring as a result of local stasis in a diverticulum constitute an indication for operation.[23] In cases in which the duodenal diverticulum produces symptoms due to obstruction to the common bile duct, pancreatic duct or the duodenum, surgery is advised.

Malignancy may occur in a duodenal diverticulum and there have been several such cases reported. Only recently Dunstan, Lowance and Jones[7] presented a case of a leiomyosarcoma which occurred in a diverticulum. In such cases prompt surgical intervention is, of course, advisable.

Surgery also may be indicated as a result of inflammatory changes. These changes may occur in the diverticulum itself, resulting in inflammation and ulceration.[32] Perforation,[2,5] abscess formation and peritonitis may result, or secondary inflammation in the biliary tree, the pancreas,[24] the retroperitoneal space and the duodenum may occur necessitating surgery. In addition, in those cases in which there is a history of repeated episodes of severe hemorrhage, surgery must be considered.

Rankin and Martin[26] believe that medical treatment is preferable but that occasionally surgical intervention becomes necessary. This view is supported by other observers, and it is to be emphasized again that there is a definite group of patients who suffer disabling symptoms which are intractable to adequate medical care.[16] In this selected group of patients, surgery should be considered for it has been shown that surgery offers complete relief of symptoms in such cases.[7,10,12,13,15,21,30] It is strongly urged that each case be considered individually and a decision reached as to the advisability of surgical intervention.

Operative Technic. Various operative technics have been advocated in the surgical management of this condition. Among these are included plication of the sac, simple inversion of the sac, anchorage of the sac to the adjacent peritoneum to avoid prolapse, amputation of the sac and various short-circuiting procedures. Inversion of the pouch and simple closure of the muscular ring, as recommended by Ferguson and Cameron,[10] have the value of simplicity, particularly in cases of limited accessibility. Mahorner and Kisner[22] believe that complete removal of the pouch is indicated wherever possible since signs of obstruction may follow upon simple inversion of the sac. However, often due to the close relationship of the diverticulum to the common bile duct and pancreatic duct or to other important structures, it may not be feasible to extirpate the sac.

Actual identification of the abnormal pouch at the operating table may be difficult. In order to overcome this obstacle, Mahorner has devised a method of air insufflation of the duodenum which greatly facilitates recognition. A posterior diverticulum may be located by incising the lateral peritoneal attachment of the descending duodenum and rotating the latter medially. After adequate mobilization of the sac, various technics, as indicated before, have been utilized. It is believed that the procedure of choice whenever possible is actual removal of the sac. This is done by transecting the neck of the sac between clamps and subsequently closing the opening in the duodenum in a transverse fashion. It is very tempting simply to invert the diverticulum after it has been adequately mobilized. This method does provide some security against leakage and contamination and is advocated whenever removal of the sac would compromise the patency of the common bile duct or pan-

creatic duct, or when other technical features would make removal an increased risk.

To minimize the danger inherent in operating upon a diverticulum arising in close proximity to the ampulla of Vater, Pearse[25] has devised a technic which he has used successfully in a number of cases. After the duodenum has been mobilized to the left, the diverticulum is exposed and drawn out to the right of the duodenum by careful dissection together with gentle traction. The diverticulum is then divided in its center parallel to its long axis, following which it is excised to within ½ inch of the duodenal wall. This cuff of tissue is left so that subsequent closure will not reduce the lumen at this point nor will the closely associated ducts be compromised in a suture.

By this means, adequate visualization of the relationship of the neck of the sac to the ducts is obtained. As an added precaution probes may be placed in both the common bile duct and the pancreatic duct and they may be left in place until the final suture is inserted in closure of the duodenum.

In this connection, if difficulty is encountered in visualizing the papilla of Vater, two possible courses are open. First, as an aid in recognition of the papilla MacLean[20] has recommended following the plica longitudinalis upward until the papilla is reached. This is possible since all the remainder of the duodenal folds, the plicae circulares, are arranged transversely to the long axis of the bowel. Secondly, a catheter may be inserted in the common duct above and passed downward through the ampulla of Vater, thus identifying the latter. The aforementioned procedures may become necessary as an aid in identification of the lower portion of the common bile duct in those cases in which the base of the diverticulum is closely related to the duct.

MacLean[20] has recommended a transduodenal approach in the treatment of perivaterian diverticula imbedded in the pancreas. In this procedure after the duodenum has been opened, an incision is made into the pancreas and separation of the diverticulum from the surrounding structures is accomplished. The diverticulum is then inverted into the lumen of the duodenum, ligated and removed. Objectionable features of this procedure are the difficulty in controlling bleeding from the pancreas and the possibility of pancreatic leakage with fistula formation.

MacLean[20] has also described a surgical approach for diverticula attached to the third and fourth portions of the duodenum. The transverse colon, together with its mesocolon, is elevated exposing the third portion of the duodenum below the attachment of the transverse mesocolon. An incision along the lower border of the posterior parietal peritoneum is made taking care to avoid the middle colic artery. The superior mesenteric vessels are displaced to the left. By this means the posterior surface of the third and fourth parts of the duodenum and the posterior aspect of the head of the pancreas are exposed.[28] Removal of the diverticulum can then be accomplished.

CASE REPORT

A white female, aged thirty-one, was admitted to Walter Reed General Hospital, Army Medical Center, Washington, D. C., on March 25, 1948, complaining of severe pain in the right upper quadrant of the abdomen. The patient's relevant past history included a cholecystectomy on July 9, 1945, for a chronic cholecystitis with cholelithiasis. Following this procedure the patient was never completely relieved of the symptoms from which she had complained prior to the operation, i.e., right upper quadrant abdominal distress of varying intensity and occasional nausea.

For a year prior to admission, the patient had severe recurrent right upper quadrant abdominal pain, which typically occurred immediately after eating, and at times was relieved by postural change. There had been no jaundice, acholic stools or dark-colored urine. Upon numerous occasions there had been associated nausea but rarely vomiting. For a two-week period just before entrance to the hospital, the pain had increased markedly in severity and narcotics were given with only moderate relief. She lost 12 pounds in weight during the preceding year, and during the past six months had had recurring attacks of diarrhea.

Physical examination on admission revealed a rather slender white female in definite abdominal distress. Examination of the heart and lungs was essentially normal. Blood pressure was 124/76. Pulse was 86 per minute and regular. The abdominal examination revealed a well healed, right rectus scar. There was definite tenderness to palpation in the right upper quadrant of the abdomen. The liver edge could

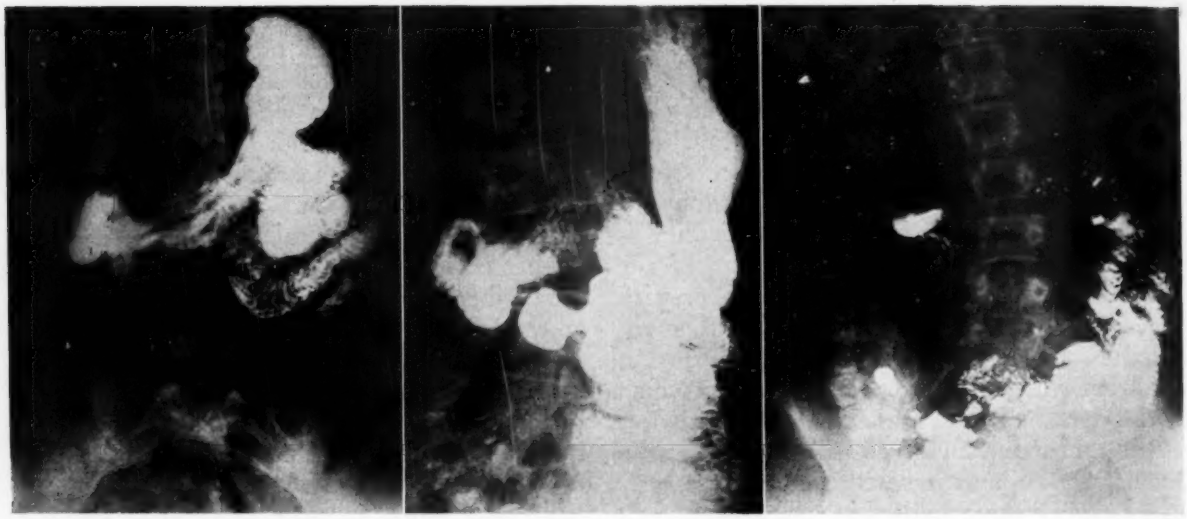

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FIG. 1. Barium study revealing the diverticulum arising from the first part of the duodenum.
FIG. 2. Oblique view showing the pouch in the first part of the duodenum.
FIG. 3. A four-hour film revealing retention of barium in the diverticulum.

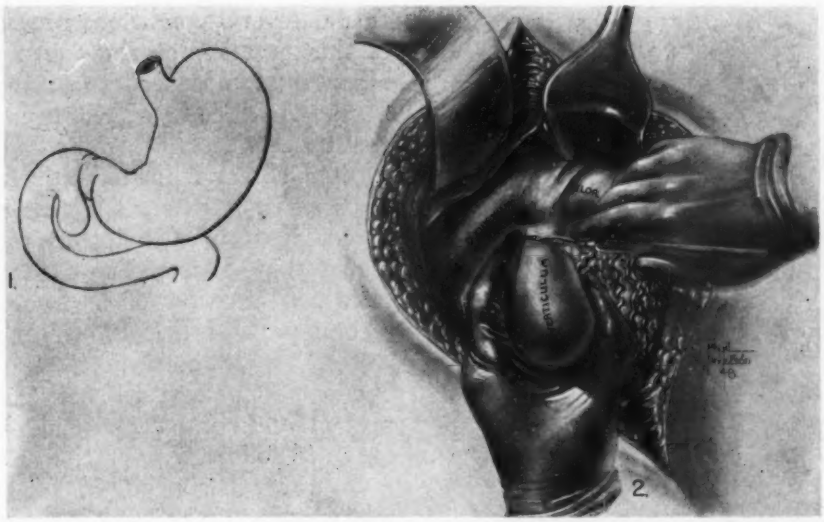
not be felt. Pelvic and rectal examinations were essentially negative, as was the remainder of the physical examination.

A complete blood count revealed erythrocytes 4,950,000 per cu. mm., hemoglobin 13.5 gm. per cent, leukocytes 6,200 per cu. mm., with a differential count of neutrophils 74 per cent, lymphocytes 22 per cent, monocytes 2 per cent, eosinophils 1 per cent, basophils 1 per cent. Bleeding and coagulation times were normal, two and four minutes respectively. A complete urinalysis was within normal limits. Serial urine examinations revealed negative tests for bile and positive tests for urobilinogen in 1:10 dilutions. Urobilinogen was also present on serial examination of the feces. The Kahn test was negative. The prothrombin time was normal. The non-protein nitrogen was 23 mg. per cent, the blood chlorides 575 mg. per cent and the basal metabolic rate +2 per cent. Gastric analysis revealed essentially normal findings. Renal dilution and concentration tests were within normal limits.

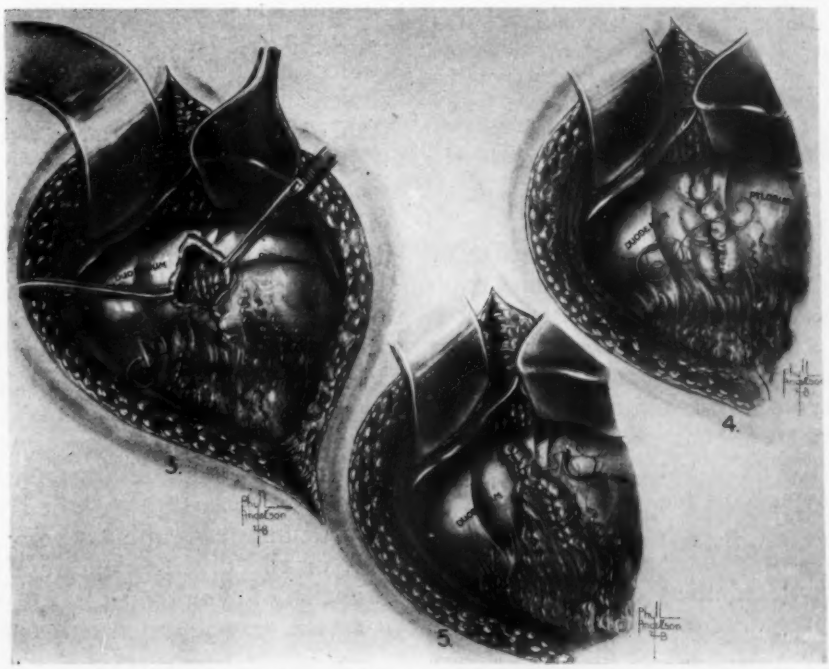
X-ray series revealed a rather large diverticulum arising from the antero-inferior aspect of the first part of the duodenum. (Figs. 1 and 2.) Barium, upon passing through the pylorus, first spilled into the diverticulum before onward passage. Although no definite evidence of obstruction was noted, the four-hour films indicated 50 per cent retention of barium in the diverticulum. (Fig. 3.) A second gastrointestinal series performed after intensive medical treatment confirmed the findings just mentioned. The barium enema was essentially negative.

In spite of adequate medical management under the direction of the gastrointestinal section over a period of several weeks, the patient continued to have disabling symptoms and the tenderness in the right upper quadrant of the abdomen persisted. Accordingly surgical intervention was recommended.

Under inhalation anesthesia on June 2, 1948, the right rectus scar was excised and the abdomen opened. Multiple adhesions were encountered and released. Complete abdominal examination was essentially negative except for the first part of the duodenum. The gallbladder was surgically absent. The common hepatic duct and the common bile duct were perfectly normal in appearance and to palpation. In addition, clear golden bile was aspirated from the common duct. The cystic duct stump was not enlarged or dilated. A smooth, ovoid pouch, 6 cm. in length, was found to arise from the antero-inferior aspect of the first portion of the duodenum. There was no evidence of any inflammatory process immediately about the diverticulum or about the first and second parts of the duodenum, nor were any adhesions present immediately around this area. There was no evidence of ulcer and no scarring. The diverticulum was mobilized and amputated at the junction of its neck with the wall of the duodenum. The mucosa of the latter appeared nor-



FIGS. 4 and 5. Sketch illustrating location of the duodenal diverticulum (1); note origin of the diverticulum from antero-inferior aspect of the first portion of the duodenum; incision of the neck of the diverticulum is made leaving a narrow cuff so that subsequent closure of the duodenum will produce no constriction at this point (2).



FIGS. 6 to 8. Transverse closure of the opening in the duodenum (3); the placement of an inverting Connell catgut suture. Reinforcement of the first layer with black silk (4). Reinforcement of the suture line with a segment of adjacent omentum (5). (Sketches do not show atraumatic needles as used.)

mal. A transverse closure of the defect in the duodenum was then performed using No. 00 chromic atraumatic catgut inverting type of suture. This in turn was reinforced with interrupted mattress sutures of black silk. In addition, a segment of the gastrocolic omentum was placed over the suture line for further protection. The abdominal wound was then closed in layers using silk technic. (Figs. 4 to 8.)

The patient's postoperative course was uneventful and she was completely free of pain and discomfort for the first time in several months. Healing of the wound per primam occurred. X-ray studies three weeks after oper-

FIG. 9. Photomicrograph of a section of the diverticulum removed at operation in the case reported herein. All of the normal elements of the duodenal wall are present indicating the true nature of the diverticulum.

ation revealed a slight operative defect in the first part of the duodenum, but passage of barium through this region was normal.

The patient subsequently was discharged from the hospital after she had been on a regular diet for a period of two weeks. She was seen in follow-up study in September, 1948, at which time her condition was excellent and there were no symptoms referable to her gastrointestinal tract. A recent communication in August, 1949, from the patient indicates that she continues symptom-free.

COMMENT

This case illustrates many of the points presented in the preceding discussion. Of definite interest is the disabling nature of the patient's symptoms necessitating operative intervention following a poor response to adequate medical therapy. The patient's discomfort and nausea can be attributed to the definite retention which occurred in the pouch. It is likely that the element of retention of food within the sac resulted in decomposition, thereby inducing the episodes of diarrhea from which the patient suffered.

As mentioned heretofore, there is no characteristic symptom complex of duodenal diverticula, several conditions producing one or all of the same symptoms. Certainly in the case report just presented the symptoms, as outlined, could easily have been due to other conditions.

Similarly, as indicated before, an exact diagnosis was not reached in this case until after thorough study of the gastrointestinal tract.

Slater and Parsons[27] in 1948 presented a case in which excision of a diverticulum of the second part of the duodenum and cholecystectomy were both performed at the same operation. Cholecystitis with cholelithiasis was present and complete relief of symptoms was obtained following operation.

On the other hand, of real interest is the relationship of the patient's symptoms to her gallbladder disease in the case herein reported. Even after cholecystectomy in 1945 there was only a rather temporary alleviation of the symptoms with further increase in their severity with the passage of time. In this connection Lucinian[18] in 1930 reported a case in which a cholecystectomy for chronic cholecystitis with cholelithiasis had been performed. In this instance there was persistence of pain and distress with a subsequent demonstration by x-ray study of a diverticulum involving the second portion of the duodenum which had perforated into the head of the pancreas. Removal of the diverticulum resulted in complete disappearance of the patient's symptoms. In 1944 Hare and Cattell[14] cited an interesting case of duodenal diverticulum simulating gallbladder colic. In spite of three previous operations and many gastrointestinal x-ray examinations, relief of symptoms was not obtained until a subsequent operative procedure revealed a perivaterian diverticulum containing several calculi. Resection of the diverticulum resulted in prompt cessation of symptoms.

In the case reported herein the patient did not obtain complete relief of symptoms until removal of the diverticulum had been performed.

In this case a true diverticulum of the first part of the duodenum was present. A search of the literature has revealed only a very few such cases mentioned. There was complete absence of any evidence of an ulcer in the sac or the adjacent duodenum. Likewise, there was no evidence of adhesions immediately about the duodenum, so that the element of traction could be eliminated. Confirmation was obtained upon gross and microscopic examination of the

specimen by the pathologist. This examination revealed that all of the normal mural elements of the duodenum were present in the pouch. (Fig. 9.)

This case is evidence of the adequate relief which surgery affords those patients having duodenal diverticula which produce definite symptoms that are intractable to medical management.

SUMMARY

1. A brief review of the literature pertinent to duodenal diverticula is presented.

2. The incidence, etiology, pathology, location and symptomatology of duodenal diverticula are discussed.

3. The features of surgical management are outlined.

4. Report of complete excision of a true duodenal diverticulum occurring in the first part of the duodenum is presented.

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PRIMARY SARCOMA OF THE GREATER OMENTUM

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PRIMARY sarcoma of the greater omentum is a rare enough tumor to warrant reporting an additional case. Menne and Birge[5] reported a collection in 1936 of eighty-four cases of apparent primary tumor of the omentum gathered from the literature. Since that time Levy and Pund[8] have reported three cases, Lawler, Fox and Cohen[9] one case, Guernsey[6] three cases and Cunningham[10] one case. As far as can be determined ours is the ninety-third case to be recorded in the literature.

Benivieni of Florence, Italy is credited with the first description of a malignant omental tumor.[6] The first reported case proved by microscopic examination was that by Simon in 1858.[6] The omentum is derived entirely from the mesoderm and, therefore, malignant lesions of this organ would have to be sarcomas. With this in mind the seventy-five original cases as reported by Sanes and Kenny in 1934[3] should probably be corrected. They have reported cases of carcinoma, endothelioma and perithelioma.

Omental sarcomas are extremely vascular and friable, with a tendency toward pseudocysts. Extension is by implantation to contiguous structures although metastasis to distant regions has been reported. There are apparently two groups of primary sarcoma of the greater omentum. The first is a solitary or circumscribed tumor with an irregular surface, rich vascularization and pseudocysts filled with a brownish fluid like prune juice resulting from hemorrhage and necrosis. In this group hemorrhagic ascites is said to be common. The second group includes the large diffuse growths. These are composed of many small and large nodules or grape-like masses which at times coalesce transforming the omentum into a thick, scarcely movable, apron-like mass. The course of tumors of this latter group is much more rapid and said to be associated with metastasis to the peritoneum.

Microscopically, the most frequent type is the spindle cell sarcoma and the most malignant type is the round cell sarcoma. Among the others listed are fibrosarcoma, myosarcoma, angiosarcoma, reticulum, round and mixed cell sarcoma, liposarcoma, myxosarcoma, alveolar sarcoma and endothelial sarcoma.

The symptoms are usually those of pain in the abdomen, the presence of a mass, a gradual enlargement and fullness of the abdomen, a sensation of pressure, anorexia, gradual loss of weight and occasionally nausea and vomiting. Fever, cachexia and anemia are inconstant. Ascites is present in 40 to 50 per cent of the cases.[3] The pain may be a constant dull ache localized near the site of the tumor (if it is a solitary or circumscribed one) and it is occasionally very severe.

Palpation may reveal a fixed mass in the abdomen which may feel solid or cystic, firm or soft, smooth or irregular. It can usually be moved from side to side but is immovable in the up and down direction. The mass seems to move with respiration and peristalsis and sometimes the pulsations of the aorta are visible through it. When the tumor is very large, it may not be as mobile. The tumor should disappear under the palpating finger when the abdominal musculature is contracted. Ascites may be present and in its absence a fluid wave should be elicited from the encapsulated fluid. In this instance the dome of the abdomen is dull to percussion and the flanks tympanitic, especially on the left.

The results of surgical treatment for sarcoma of the greater omentum, which is our only hope of cure, are very poor. X-ray therapy has not proved of great benefit, however, Levy and Pund[8] suggest its use before operation. If possible it is obviously best to excise the entire tumor *en masse* without aspiration or rupture of any of the pseudocysts.

CASE REPORT

Mr. C. S., a forty-six year old white male, was admitted to the Columbia Hospital (No. 39185) on March 7, 1949, with a complaint of pain in the upper right side of his abdomen of

one day's duration. He had been hospitalized in May, 1948, for hypertensive cardiovascular disease. There was nothing found at that time to suggest a relation to his present condition. Upper gastrointestinal x-rays revealed a slight deformity of the duodenal cap which was apparently the result of a pre-existing ulcer quiescent at the present time.

The patient stated that he had had a sudden onset of sharp pain in his right flank on the night before admission. The pain was intermittent in character and did not radiate. It was of a gnawing type when present and during one of the episodes of pain he vomited. His bowel movements had been normal in consistency and character and he had had a normal stool on the morning of the examination. On closer questioning the patient did admit that during the month previous to admission he had had two or three similar episodes of abdominal pain but none had been severe enough to alarm him or make him consider seeing a doctor. He had the feeling that his abdomen was getting larger and heavier. His appetite had been fairly good and he had gained some weight during this period. Recently he had had some minimal digestive disturbances. He had been working regularly but seemed to think that he was not as strong as he had been. There was no history of chills and fever.

Physically, the patient was a fairly well developed adult white male of about the stated age. There was no apparent weight loss and the skin was somewhat ashen and of normal texture. The facies was that of an ill man and suggested malignant disease. The remainder of the physical examination was essentially negative except for the heart and abdomen. The heart was enlarged to the left and downward with point of maximum intensity being in the sixth intercostal space and about 3 inches from the mid-sternal line. The rate and rhythm were normal and no murmurs were present. Blood pressure was 236/120. The abdomen was generally distended but there were no enlarged, superficial, abdominal veins present.

Palpation revealed considerable rigidity in the right upper quadrant with some pain on pressure. The lower quadrants were soft and without tenderness. There was tenderness in the right costovertebral angle and a suggestion of a mass felt in the right upper quadrant. There was a definite fluid wave felt in the abdomen which was dull to percussion over its entirety except in the left flank. The tympanitic note heard in the left flank was present in all positions. This seemed to indicate to the examiners the presence of encysted abdominal fluid. Peristalsis was normal. There was no evidence of hernia and the genitals and extremities were normal. Rectal examination revealed a normal prostate and no fullness nor tenderness in the cul-de-sac.

The admission laboratory work revealed a leukocytosis of 11,700, with 80 per cent polymorphonuclears and 20 per cent lymphocytes. The red cell count was 4.8 million with 80 per cent hemoglobin. The urinalysis was normal. The day after admission the white blood count was 13,650, with 84 per cent polymorphonuclears, 14 per cent lymphocytes, one monocyte and one basophil. A scout film of the abdomen revealed "a large tissue mass or abdominal fluid obscuring the renal and upper abdominal soft tissue shadows." Examination was repeated three days after admission and was essentially the same in that "the renal and psoas muscle shadows were obliterated by a diffuse density over the entire mid-abdomen." This density had the appearance of peritoneal fluid. Electrocardiogram showed marked left axis deviation and a slightly low T wave in CF_4 and CF_5. Cystoscopic examination was entirely normal including retrograde pyelograms and dye studies.

As a result of the initial examinations the following diagnoses were at first entertained: hypertensive cardiovascular renal disease, duodenal ulcer with slow perforation and omental sealing, perirenal abscess, amebiasis, intra-abdominal (mesenteric) cyst and malignant disease of unknown origin.

On March 17th laparotomy was performed through a right paramedian, mid-abdominal incision splitting the rectus muscle. Upon opening the peritoneal cavity a large cystic mass was encountered which practically filled the entire cavity. The mass was attached to the parietal peritoneal wall in many places and the large size of the vessels in these attachments were immediately noticed. After some of these attachments had been freed between ligatures, the mass was found to be omental. The entire small bowel was in the left hypochondrium and the liver was normal. It was decided to collapse the cystic tumor and make

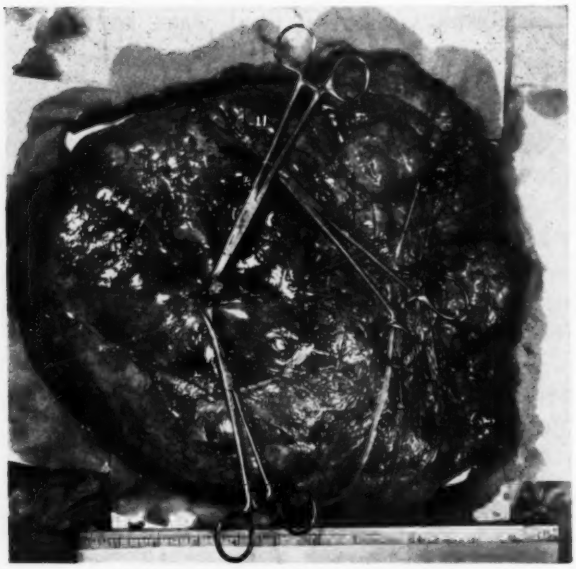

FIG. 1. Spindle cell sarcoma of the greater omentum measuring about 14 inches in diameter and containing 2,200 cc. of fluid like prune juice.

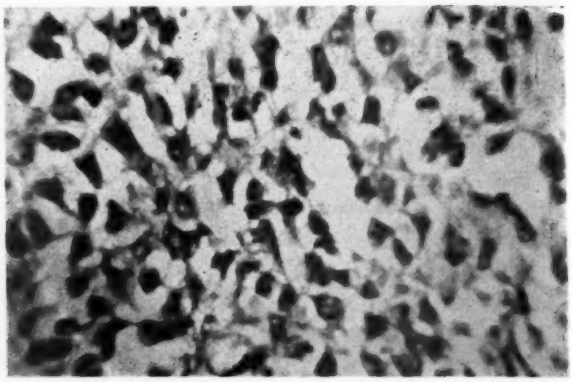

FIG. 2. Spindle cell sarcoma showing large, irregular, spindle-shaped, highly atypical cells with large, vesiculated, hyperchromatic nuclei; mitotic figures are poorly defined and the supporting framework loose in quantity and fibrillar in type.

an attempt to resect it. This was done with special technical care and 2,200 cc. of fluid like prune juice were aspirated from the cystic cavity. The tumor was then delivered on the abdominal wall *en masse* and was found to have arisen from the right half of the greater omentum. The left half of the greater omentum at its attachment on the stomach was normal. It was a simple technical procedure to excise the tumor from the stomach and transverse colon by piecemeal ligation. In its collapsed state the tumor measured about 14 by 14 inches. It was pinkish to grey, hemorrhagic looking and made up of multiple nodular, irregular, cystic, grape-like masses and large solid areas of brain-like consistency. The vessels coursing the outside of the tumor were numerous and often the size of a lead pencil. When the cystic cavity was opened, the interior was rough, granular and ragged looking with deposits of old blood on the walls. (Fig. 1.)

The microscopic examination was as follows: "Microscopic sections of this tissue reveal the presence of a highly cellular, malignant tumor which is made up of cells of many shapes and sizes but amongst which the dominant shape is spindle or cigar. These cells are supported by a very poor framework of pink staining, granular, collagenous material and have irregularly shaped nuclei which are mostly spindle in shape. These nuclei are sharply defined, vesiculated and hyperchromatic. Mitotic figures are difficult to see and when found are very poorly developed. The tumor has an enormous vascular supply through vessels of capillary size and larger and also through spaces of such size as to be classed as sinuses. Most vessels are, especially the sinuses, highly embryonic in their development and their walls consist largely of a single layer of endothelial cells supported only by adjacent tumor cells. As a consequence of this arrangement, numerous large and small hemorrhages are present in the tissue and the inner wall is covered by old fibrin and blood clot." (Fig. 2.)

The examiner's comment on this was, "It seems probable that this tumor was originally a solid one and that a fairly recent hemorrhage occurred into its interior and thus gave rise to a pseudocystic appearance. The large blood sinuses suggest the possibility of an original hemangioma but it seems more probable that their size has resulted from the development of the tumor in a region where there has been unrestrained growth with marked dilatation of poorly developed blood spaces." Where the tumor had been attached to the abdominal wall in several places pieces of tissue were removed and sections of these tissues revealed the presence of tumor with the same characteristics. The diagnosis was that of spindle cell sarcoma of the omentum.

Postoperatively, the patient made an entirely uneventful recovery. He was remarkably relieved by ablation of the tumor and was discharged from the hospital on March 28, 1949, the eleventh postoperative day. When last seen although he had not regained a great deal of

strength he had gained 11 pounds and said he felt better than he had in many months.*

SUMMARY

The ninety-third recorded case of sarcoma of the greater omentum is presented. Even though the patient had had several minor attacks of abdominal pain in the few months before admission, his admission was for right upper quadrant pain of one day's duration. The diagnosis was made at operation and the technical excision of the tumor mass was simple. A review of the literature is presented in brief.

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* This patient was seen in July, 1950. At that time he had gained weight, was entirely asymptomatic and was working full time.

COCCIDIOIDOMYCOSIS OF FEMALE ADNEXA*

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THE purpose of presenting this report is the extreme rarity of coccidioidomycosis of the female adnexa. In the past only two cases of dissemination of this condition have been reported, one by H. Jacobson[1] and another by Page and Boyers.[2] In both cases reported complete recovery followed total removal of the infected adnexa. The case reported herein may well be a third such case.

Epidemiology. Coccidioidomycosis is endemic in the southwestern United States, particularly in southern Arizona and the San Joaquin Valley of California. However, coccidioidal infections have been reported from the Argentina-Uruguay area and in other parts of the South American continent. Isolated cases have been reported from Hawaii and Italy.

Pathogenesis. Infection by the fungus, Coccidioides immitis, usually takes place by inhalation and the primary infection occurs in the lung. However, abrasions sustained in the infested desert areas may result in skin infection. C. immitis is a diphasic organism, and in its infectious stage it is represented by chlamydospores which are highly infectious, cling to clothing and may be transmitted quite a distance. They lie in the dust and in the shrubs in the foothills of the mountains. The chlamydospores represent the saprophytic or infectious phase of the fungus; the parasitic or spherular phase is a non-infectious phase or what we actually see in the tissues and body fluids which have already become infected by the chlamydospores. When infection takes place through the lungs by inhalation, it may be demonstrated roentgenologically although physical findings may be negative. However, there will be no suspicion of coccidioidomycosis until there is evidence of dissemination of the fungus elsewhere in the body. Dissemination to other parts of the body through the blood stream from the lungs is not too frequent. Charles E. Smith of Stanford University states that in not more than one infection in 1,000 does the fungus disseminate, but when it does it is usually disastrous. It is believed that cold abscesses of the skin and skin lesions are more the result of dissemination of primary pulmonary infection rather than primary infection of the skin itself. Several cases of dissemination of the infection to the bones, joints, skin and meninges have been reported.

Diagnosis. Coccidioidomycosis once suspected may be diagnosed by the intradermal use of 0.1 cc. of 1:100 dilution of coccidioidin. The reaction is similar to the Mantoux reaction and is read thirty-six hours later. The complement fixation test is diagnostic and also very valuable in following the course of the disease. The titer of complement fixation rises with the severity of the infection so that in disseminated infection it may be complete in 1:256 serum dilution. It is thus valuable in warning of impending dissemination of the infection.

CASE REPORT

The following is submitted as the third case of coccidioidomycotic infection of female adnexa on record:

The patient was a twenty-three year old colored female seen with a complaint of severe postmenstrual pain and a profuse, white, thick vaginal discharge for the past year. Premenstrual pains had gradually increased in severity in the weeks preceding admission to the hospital. Onset of menses was at nineteen years of age and the periods had been regular, every twenty-eight days, and of three to four days' duration. The patient had not had menstrual pains prior to the present illness. She had been married two years and had had no pregnancies. About eighteen months prior to admission, while picnicking she had been thrown off a horse into a pile of dust and sagebrush. Soon after this fall two "kernels" developed, one in the right supraclavicular region and the other over the left external malleolus. These lesions were treated by a local physician who incised and drained one; the other opened

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spontaneously. After this the patient recovered and improved in general health. However, several months later she began to have a profuse vaginal discharge associated with pelvic pain for which she was given penicillin by her local physician. As the pelvic pains persisted, further examination disclosed adnexal disease for which surgery was advised. She was admitted to St. Monica's Hospital April 9, 1949, and was operated upon two days later.

The patient gave a history of having had measles and chickenpox in childhood. She had had an appendectomy at the age of thirteen years. There were no other serious illnesses or operations.

On physical examination there was a small area at the site of former drainage of a carbuncle on the right side of the neck just above the clavicle. The abdomen revealed a lower right rectus scar. There was diffuse, nodular, tender fulness in the lower abdomen and tenderness on deep palpation over the symphysis bilaterally. Bimanual examination of the pelvis revealed the cervix to be normal in size and consistency. There was a fluctuant, tender mass in the left fornix. There was a nodular, hard mass in the posterior pelvis which appeared to be fixed and difficult to move. Manipulation of the cervix was very painful to the patient. The extremities were normal except for a scar on the external malleolus of the left ankle. At this time a diagnosis was made of left tubo-ovarian abscess and fibroid uterus.

Laboratory work revealed the following: Kahn test, negative; urine, negative; red blood cells, 4,100,000; hemoglobin 77 per cent; white blood cells, 12,650; basophiles, 1; eosinophiles 2; stabs, 6; segmented, 46; lymphocytes, 43; and monocyctes, 2. There was moderate hypochromia. X-ray examination of the chest revealed no pathologic condition of the lungs.

On April 11, 1949, the patient was prepared for surgery contemplating an abdominal and a vaginal approach. A midline incision was made from the symphysis pubis to and slightly to the left of the umbilicus. The rectus fascia was incised mesially and the muscle separated in the midline. The peritoneum was opened and the abdominal cavity exposed. With the patient in the Trendelenburg position the omentum was carried down over the small intestines and packed away from the pelvis. The pelvis revealed a large mass in the midline. It was covered with visceral peritoneum. The visceral peritoneum and the lower portion of the abdominal parietal peritoneum as well as the small intestines were covered with small, angular, irregular nodules approximately 1 to 3 mm. in diameter. The omentum was of a mealy consistency, devoid of fat to a degree, and adherent to the anterior abdominal wall. The small bowel was matted together and adherent to the uterus and the mass in the left pelvis by fairly dense adhesions. The adhesions were freed and the mass was approached by doubly ligating the round ligament, encircling the mass in the endopelvic fascia by blunt dissection. The mass was delivered intact without rupture and left a deep cavity, with moderately severe bleeding, in the left pelvis. Due to bleeding in the cavity from the area where the tubo-ovarian mass had been, oxycel gauze was packed using three rolls in the cavity. The appendix had been removed at a previous operation. The abdomen was closed in layers using No. 00 chromic catgut to the peritoneum, No. 2 chromic catgut to the fascia and clips to the skin. No drainage was instituted. The patient was returned to the ward in good condition.

The large, thin-walled, tubo-ovarian mass was approximately the size of a grapefruit. The postoperative diagnosis was left tubo-ovarian mass and possible tuberculosis of the pelvic and abdominal peritoneum and the viscera.

The postoperative course was uneventful. The patient was given antibiotics as a prophylactic measure. Her temperature became normal in three days and she left the hospital ten days postoperatively. When seen twice in a two-week interval following her discharge from the hospital, her wound was solid and there was no evidence of sinus formation. She was gaining weight and feeling well, having no pain.

The pathologic report revealed the following: Grossly, the specimen was comprised of a tubo-ovarian mass which measured 4 by 6 by 11 cm. The ovary had been converted into a large mass, cystic in nature, which on sectioning represented a multilocular cystic structure, all of which were filled with thick, creamy, yellowish green, purulent material. The wall of the cyst was thin. However, in some areas the wall measured 4 to 6 mm. in thickness. Sections through this area were also taken for histologic study. On the surface of this ovarian cystic structure there were remnants of a tube still discernible. Sections of these were taken for histologic study also. The tube was found to

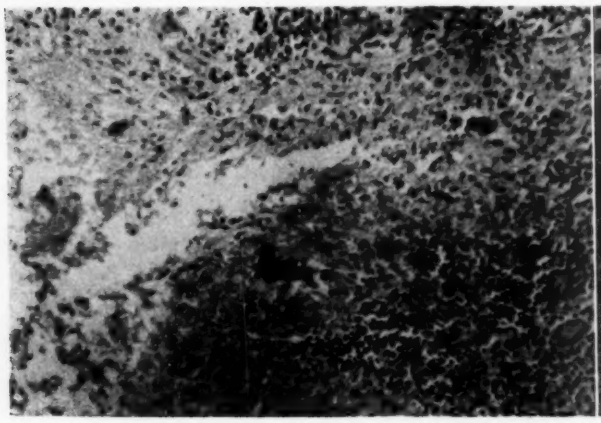

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FIG. 1. Coccidioidal granuloma involving wall of fallopian tube.
FIG. 2. Note the endosporulating spherule of C. immitis in giant cells.

be thickened. The muscular coat was thickened and the mucosa was swollen. The lumen was somewhat narrowed. Representative sections were taken.

Microscopically, sections through the fallopian tube revealed that the mucosa had been completely altered and was no longer discernible. The inner lining was replaced by a chronic inflammatory reaction characterized by granuloma in which "tubercular" lesions existed. Within these "tubercular" lesions and granulomatus tissue characteristic endospores of C. immitis were found. The muscular coat was diffusely infiltrated with lymphocytes, plasma cells and an occasional polymorphonuclear leukocyte. The serosa was similarly infiltrated. Sections through the wall of the ovarian cystic structure showed that the inner lining of the wall was also replaced by chronic granulomatous tissue which also presented numerous endospores of C. immitis. (Figs. 1 and 2.)

The pathologic diagnosis was coccidioidomycosis of fallopian tube and ovary.

COMMENTS

The question of giving this patient additional treatment following surgical intervention arises. Patients in the past have been treated with colloidal copper which seems to have been of benefit. Other patients have received x-ray therapy, and still others injections of coccidioidin. One of the surgical cases reported the patient received no therapy whatsoever and apparently made an uneventful recovery. It is the opinion of the surgeon that this patient should not be given additional therapy for fear that there may be a further dissemination of the infection.

Review of the literature reveals that two cases of coccidioidomycotic infection of the pelvic organs of the female have been reported. We believe that the case presented is the third. According to other authors, when disseminated coccidioidomycosis has stabilized itself, the predominating lesions should be removed if amenable to surgery. The removal of the tissue involved may be sufficient in the therapy of the individual; however, subsequent follow-up studies of this and similar cases will determine the choice of the method of treatment.

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RETROPERITONEAL TERATOMA*

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RETROPERITONEAL tumors in young children pose a great problem in diagnosis and treatment. The majority of them prove to be derived from the adrenal glands or from nephrogenic tissue. Complex mixed tumors and teratomas which proved to be malignant have frequently been described. Recent reviews by Lahteenmaki,[1] Arnheim[2] and O'Leary and Halpert[3] denote the rarity of retroperitoneal teratomas composed only of adult tissues and therefore relatively benign. According to the most recent paper by O'Leary and Halpert[3] their case was the fifth retroperitoneal teratoma successfully removed by surgery.

We wish to report a case of a retroperitoneal teratoma successfully removed from a five month old girl, with uneventful recovery.

CASE REPORT

This five month old white female infant entered the hospital one week after the family physician had discovered an abdominal mass at routine physical examination. Examination two months earlier was said to have revealed no abnormality. The histories of family, birth, feeding and development disclosed nothing remarkable. The patient had been an active, alert and vigorous child with no symptoms referable to her present illness except possibly a disinclination to lie on her abdomen. Physical examination on admission revealed a large, firm, non-tender, rounded, nodular mass approximately 5 cm. in diameter palpable low in the left upper quadrant. This mass did not move on respiration. X-ray examination showed that the small bowel was displaced by a soft tissue mass. (Figs. 1 and 2.) Several well outlined calcifications appeared to be in the region of the tumor. Intravenous pyelogram revealed that the left kidney was displaced downward but there was no distortion of the superior calyx system. Fluoroscopy of the colon was essentially normal. The lung fields were clear. The x-ray impression was of a tumor probably arising in the left adrenal, superior pole of the kidney or tail of the pancreas.

January 2, 1947, a laparotomy was performed through the left upper quandrant by a transverse incision dividing the rectus muscle. The mass presented itself immediately. It was retroperitoneal and lay medial to and above the left kidney. It was hard and nodular in some places and felt cystic at its lower pole. In order to permit freeing of the upper end which lay close to the liver the incision was extended across to include the right rectus muscle. The intestines were packed out of the way and the tumor was dissected free. It was encapsulated and was shelled out with moderate difficulty from its bed. Stretched along its medial border was tissue which appeared to be a normal but flattened adrenal gland. Entering the tumor on its deep surface were several large blood vessels which were clamped, divided and ligated. A small, tubular, non-vascular structure emerging from the lateral border was ligated and cut. The abdominal wall was then closed in layers. The patient received a transfusion of 250 cc. whole blood at operation and another 200 cc. of blood the next day. Fluid balance was maintained by parenteral administration of normal saline and 5 per cent dextrose in distilled water. Wangensteen suction was used for two days. The patient had a moderate fever which subsided by the fourth postoperative day. She was given 460,000 units of penicillin during the first four days. She was discharged on the twelfth postoperative day and when last seen on February 11th she was entirely well.

The pathologic report revealed the following: Grossly, the specimen consisted of a bi-lobed mass weighing 173 gm. The inferior and larger lobe measured 7 by 6 by 4.5 cm. and the smaller 4 by 4.5 by 3.8 cm. The entire mass was well encapsulated and the two lobes were connected by a constricted area 4 cm. in diameter. (Figs. 3 and 4.) There were five small cysts attached to the capsule on the lateral border, the largest being 1 cm. in diameter. There was also a

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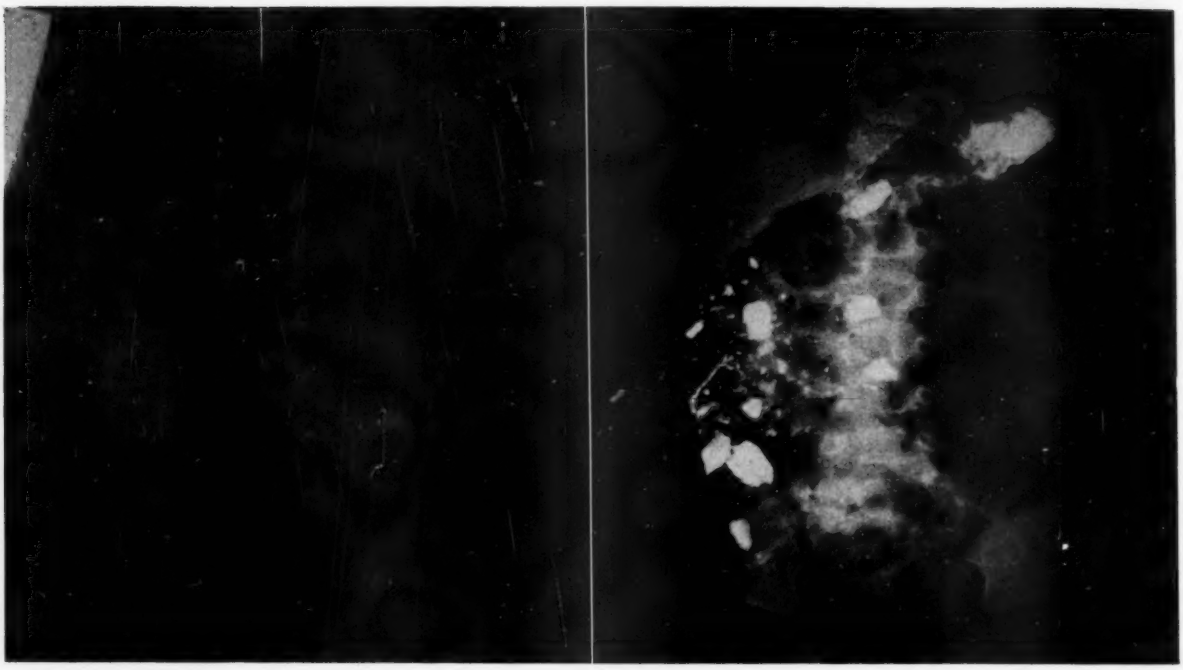

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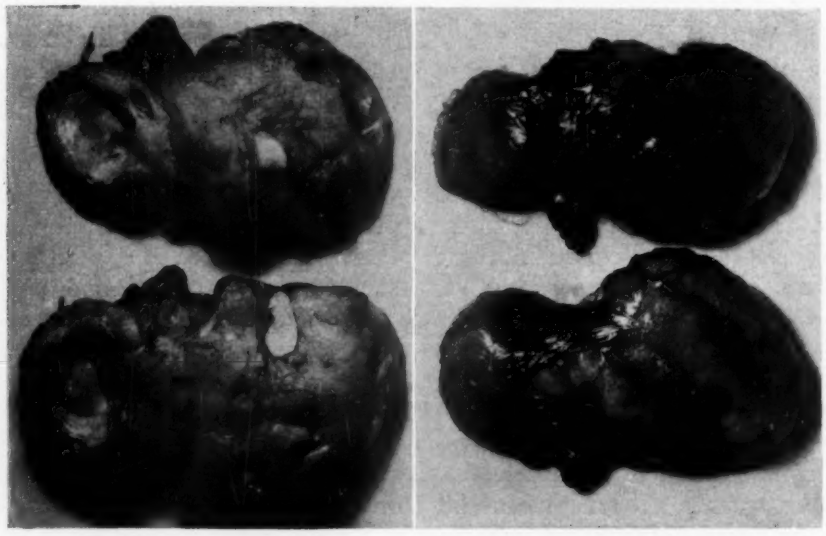
FIG. 1. Intravenous pyelogram showing left kidney displaced downward by a tumor mass containing many calcified areas.
FIG. 2. The small bowel pushed toward the right side of the abdomen.



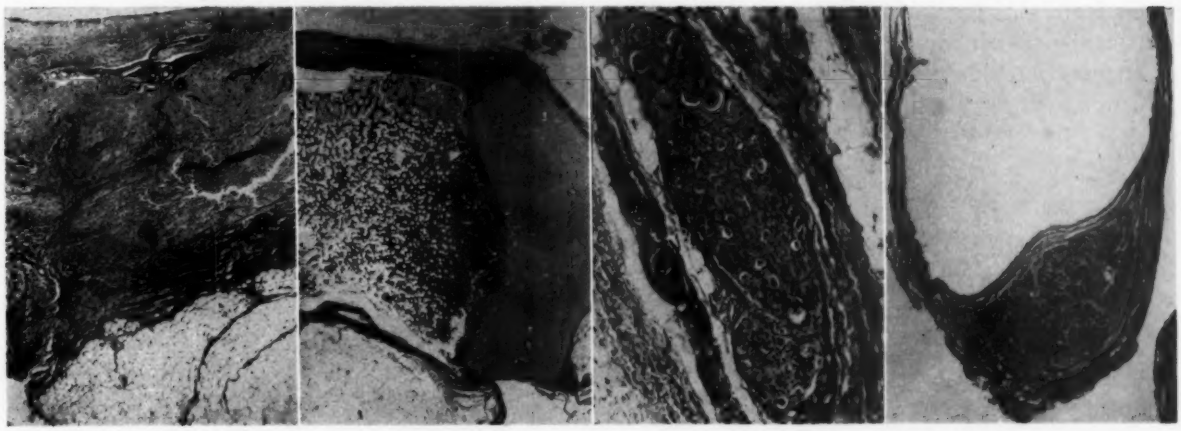
3 4

FIG. 3. Tumor bisected showing the cysts in both upper and lower parts.
FIG. 4. Outside of tumor showing the small attached cysts.

flattened cyst measuring 2.5 by 2 cm. with a wrinkled, pink surface and containing a small amount of cheesy white material. An adrenal gland was loosely attached to the medial border of the tumor mass. On cut section the tumor was white and felt greasy. The smaller lobe contained a central cyst 2 cm. in diameter with a smooth, pale gray lining and containing some clear fluid. The larger lobe contained a multiloculated cyst at its lower pole measuring 2.5 by 1 by 1 cm. Embedded in the mass were five pieces of bone and cartilage. The largest was 1.8 cm. long; in its center there was a reddish area which on transillumination ap-

5 6

FIG. 5. X-ray of specimen showing well formed bones and epiphyseal lines.
FIG. 6. X-ray of bones dissected from specimen.



7 8 9 10

FIG. 7. Lacy glial tissue.
FIG. 8. Adult bone with epiphyseal line.
FIG. 9. Nerve ganglion.
FIG. 10. Pancreatic tissue embedded in bowel wall.

peared to be an ossification center. The resemblance of these structures to bones can readily be seen on x-rays of the gross specimen. (Figs. 5 and 6.)

Microscopically, the bulk of the tumor was composed of fatty tissue in which there were areas containing blood vessels, bundles of smooth muscles and fibrous tissue, glial tissue, nerve fibers, ganglia, pacinian corpuscles and pieces of bone and cartilage. Sections from the bi-lobed mass revealed the following: (1) adipose tissue differing from normal fat only in its lack of regular lobular pattern was shown. (2) Some glial tissue resembling brain composed of lacy fibrils, astrocytes and microglia was shown. This tissue rested on dense, hyalinized connected tissue and the line of demarcation was very distinct. The vessels penetrating this tissue were surrounded by hyalinized connective tissue. (Fig. 7.) (3) Section through one of the pieces of bone showed an adult bony cortex with periosteum. The marrow was normal and there was an epiphyseal line separating hyalin cartilage from marrow. (Fig. 8.) The bony structure with the distinct shaft illustrated in Figure 6 had

cartilaginous epiphyses and rudimentary joint spaces. (4) This section is of interest chiefly because of an area showing neurons embedded in nerve fibers constituting well defined ganglia. (Fig. 9.)

Sections through the small cysts attached to the lateral border of the main mass revealed various structures: (1) Several sections of bowel with gradation of the mucosa from a small intestinal to a colonic type were shown. The lumens of some of them contained mucus. There were some areas lined with a single layer of tall goblet cells. In others distinct Paneth cells could be seen at the bases of the crypts. The walls showed relatively normal muscular layers and nerve plexuses could be seen. (2) One section resembling bowel but lined with simple columnar mucous cells contained pancreatic tissues with normally formed acini islets and ducts. (Fig. 10.) (3) Well formed hyaline cartilage and a section of a small "rib" with normal cortex and marrow were shown. (4) Also from this area was a segment of a tubular structure which was transected at operation. This section showed a stratified squamous epithelial lining with much keratinization and below this a thick layer of collagenous connective tissue. Extrinsic to the mass but attached to its surface was a small piece of normal adrenal gland.

SUMMARY

The clinical history and detailed pathologic discussion is presented of a five month old female from whom a retroperitoneal teratoma was successfully removed.

The unusual features of this tumor were the well differentiated organoid structures incorporated within it. These included bone and cartilage with epiphyseal line, several sections of gut, pancreas and some brain-like tissue.

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